ELECTRONIC / ELECTROMECHANICAL

production

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ASTOR LENOX & TILDEN FOUNDATIONS

FIRST ISSUE

[Vol. 1, No. 1]

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SCI & TECH

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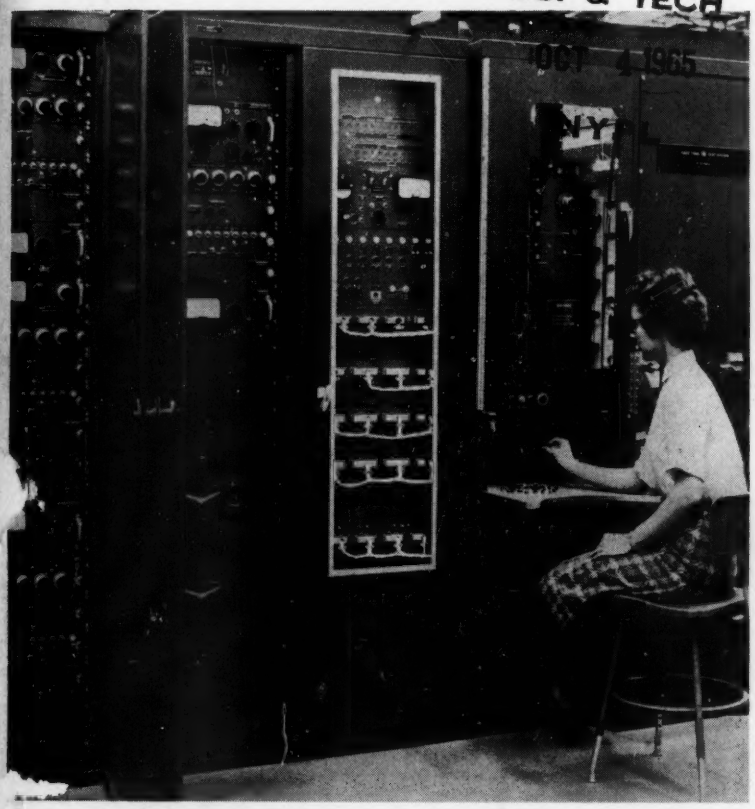
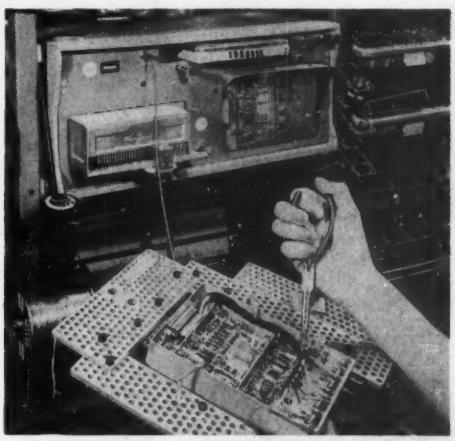
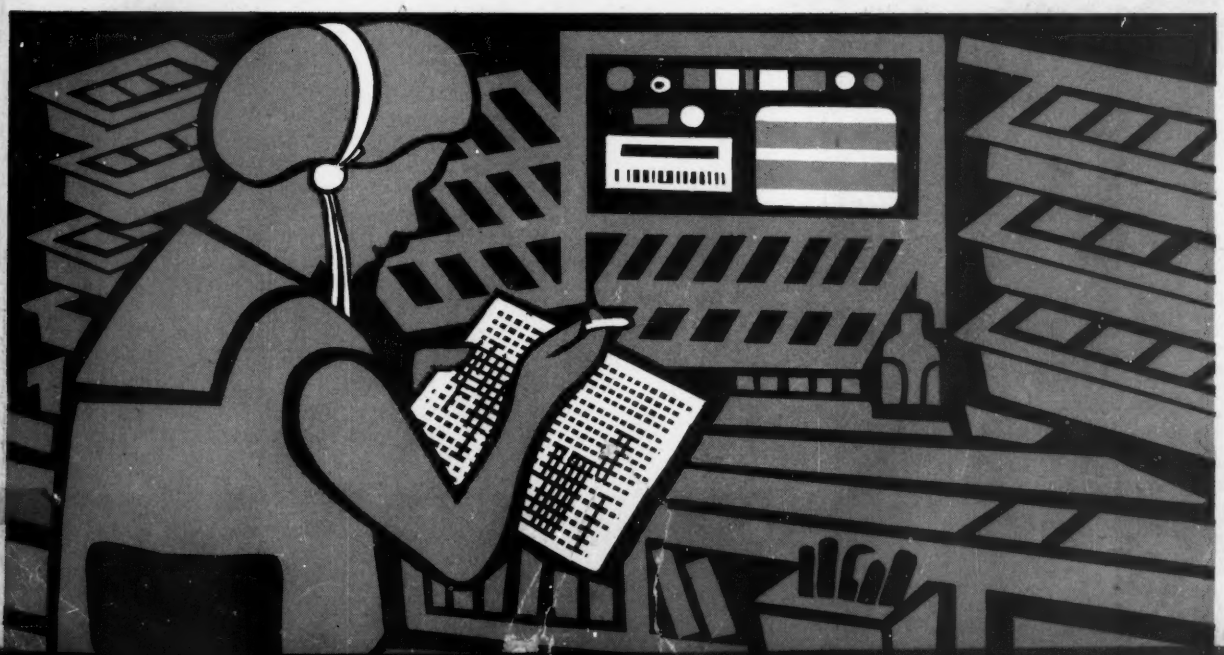


- Audio-Visual Aids
- Ultra-Reliability
- Automated Quality Control
- Production Line Soldering





WE BROKE A DOZEN SCREWS, BUT

we couldn't make this sheet metal insert spin in its hole!

THE INSERT PROBLEM

A hole punched in thin sheet metal doesn't provide enough surface for threading. You often have to supply the threads by installing an insert.

But the same hole doesn't provide much surface for *gripping,* either. The insert spins.

WHAT WE DID ABOUT IT

The insert we tested was designed with an *angular* knurl around a cone-shaped gripping perimeter. Here's what happened:

First: When we mated the sheets, put in a screw, and tightened it in the insert, the screw pulled the insert toward the sheet. It also pulled the teeth of the angular knurl more firmly into the edges of the hole, increasing their resistance to spin.

We broke screws (No. 8, 10, 12, and ¼ sizes) by overtorquing them. But the only effect on the insert was to tighten it.

Second: When the insert was first pressed into the hole, the angular knurl displaced metal, squeezing it toward and into a groove around the bottom of the insert. This locked the insert against being pushed out before the screw was tightened. After tightening, the lock was intensified by the added squeezing pressure of the angular knurl.

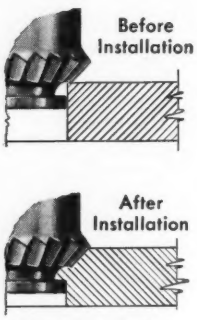
WE'LL SEND SAMPLES

If you've had this insert problem, drop us a line on your letterhead. We'll send some Southco THREDS (that's their name) for you to try. No obligation, of course. Write Southco Div., South Chester Corporation, 265 Industrial Highway, Lester, Pa.

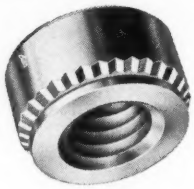
THREDS . . . AND THE ANGULAR KNURL PRINCIPLE

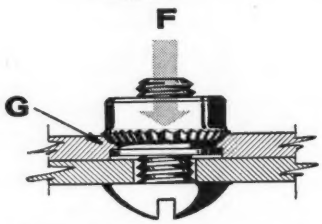
Southco THREDS are installed by pressing into a single hole in the sheet, provide thread length equal to or greater than that of a standard nut. One insert fits any sheet thickness (see minimum requirement, last column in table below). Material is case hardened steel, Cad. plated per Fed. Spec. QQ-P-416 Type II, cl. 2, yellow iridite.

ANGULAR KNURL
(detail)

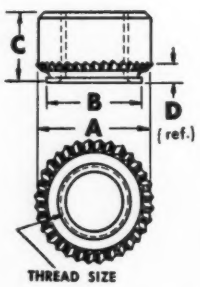


Teeth bite into edge of hole, force metal into locking groove at base of insert.





Additional torque on screw increases force F, pulling teeth of angular knurl more firmly against sheet and putting extra pressure on metal in locking grove G.



SOUTHCO THREDS[T.M.] . . . SPECIFICATIONS

THREAD SIZE	PART NUMBER	A	B	C	D	Weight per M (lbs.)	Min. Sheet Thickness
4-40 NC	74-11-104-13	3/32	.185	5/32	3/64	1.22	.036
6-32 NC	74-11-106-13	3/32	.247	5/32	3/64	1.99	
8-32 NC	74-11-108-13	5/16	.278	3/16	3/64	2.87	.048
10-24 NC	74-11-110-13	5/16	.278	3/16	3/64	2.51	
10-32 NF	74-11-210-13	5/16	.278	3/16	3/64	2.53	
12-24 NC	74-11-112-13	13/32	.372	3/16	1/16	4.56	.060
¼-20 NC	74-11-125-13	13/32	.372	3/16	1/16	4.28	
¼-28 NF	74-11-225-13	13/32	.372	3/16	1/16	4.32	

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SOUTHCO FASTENERS

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LOOKING FOR A FASTER AND MORE ECONOMICAL WAY...

TO FORM COMPLICATED WIRE & RIBBON METAL PARTS

NILSON 4 SLIDES
NILSON FOURSLIDE
DESIGN & TOOLING HANDBOOK
Wire and Ribbon Metal Forming FOURSLIDE Machines
THE A. H. NILSON MACHINE COMPANY
Shelton, Connecticut, U.S.A.

If you are looking, it will pay you to investigate NILSON Fourslide Forming Machines, which can handle wire diameters from 0.010" to 0.5" (feed lengths to 32") and ribbon stock up to 4" wide (feed lengths to 24"). And, parts can be produced at rates over 400 per minute.

NOW—NILSON'S NEW "FOURSLIDE DESIGN AND TOOLING HANDBOOK" is available.

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We invite you to write today for your free NILSON "FOURSLIDE DESIGN & TOOLING HANDBOOK". You will also receive the new NILSON Bulletin No. 62 covering the widest range of FOURSLIDES available—17 models.

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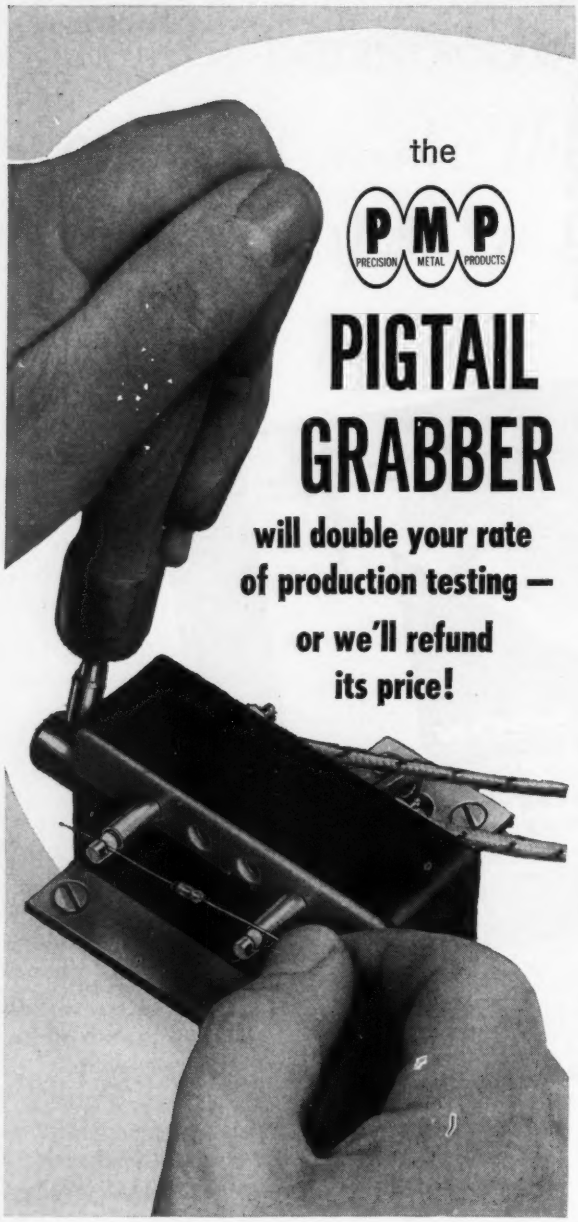
TTFA CIRCUITS

(advertisement)



the PMP PRECISION METAL PRODUCTS

PIGTAIL GRABBER

will double your rate of production testing — or we'll refund its price!

This semi-automatic, production-test fixture is the fastest, surest way to connect pigtailed components into test circuits

It lets you test pieces as fast as they can be dropped into and lifted from the "pigtail grabber" — and that is *fast!*

Order a "pigtail grabber" today, and prove its value for yourself. Price: complete bench-mounting fixture with handle and foot-treadle — $32.50 net. FULLY GUARANTEED.

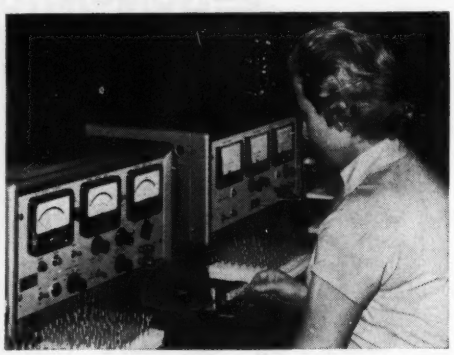
PRECISION METAL PRODUCTS COMPANY
41 ELM ST., STONEHAM, MASSACHUSETTS

CIRCLE NO. 3 ON INQUIRY CARD

INSPECTION-TIME CUT 50 PERCENT

By Simple Test-Fixture

The headaches associated with high-reliability inspection, for electronic components used in military and space-exploration programs, have been substantially reduced in the quality-control department of a leading manufacturer of semi-conductors with the adoption of a new, semi-automatic test fixture.



Not only has handling-time been so sharply reduced that inspection is reported to be twice as fast as formerly, but unprecedented accuracy in testing has been experienced. The latter results from the uniform, low-resistance contact provided by the test-fixture.

The device that has proved so valuable in the testing of axial-leaded rectifiers at North American Electronics, Inc., Lynn, Massachusetts, was designed by Precision Metal Products Company, of Stoneham, Massachusetts and is colloquially termed a "pigtail grabber". As its name implies, this fixture seizes the pigtail connections of such components as diodes, transistors, rectifiers, resistors, and capacitors and holds them securely while test measurements are being made.

All the features necessary for high-speed production-testing of small components are provided by the "pigtail grabber". Wide-opening, spring-loaded grippers, with V-shaped slots into which the pigtails are dropped, are spaced at the right distance to accommodate the components being tested. The grippers are opened by pressure on a handle or on a foot-treadle and are closed by spring-pressure as soon as the handle is released. At North American Electronics, Inc., foot-treadle operation is used; this leaves the operator with both hands free for loading and unloading the fixture.

Since the test-instrument leads are securely attached to the fixture by soldering or by bolt-on connection, and since the individually spring-loaded grippers provide a shear-type contact, the "pigtail grabber" introduces no variable resistance or other factor requiring compensation and it is reported, by users, to be "100% accurate" in its results.

ELECTRONIC/ELECTROMECHANICAL production

FIRST ISSUE

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control systems, transistor powering, computer systems, test equipment, guided missile circuits, aircraft electronics, telemetry circuits, DC filament supplies, magnetic amplifier references, bias sources.

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FIXED AND SEMI-VARIABLE

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Higher current capabilities in a smaller lighter package . . . greatly improved efficiences and reliability . . . less heat per watt input . . . no filament power losses . . . reduced transformer and rectifier losses . . . no warmup time . . . longer life.

COMPLETE SERVICEABILITY
All components accessible for checking and replacement . . . potting has been eliminated and a printed circuit board incorporated for compact packaging.

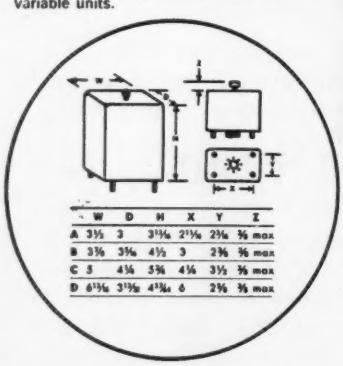
EFFICIENT HEAT TRANSFER
Accomplished by mounting the power transistor on the geometric center of the black anodized aluminum housing, which becomes an efficient black body radiating heat sink . . . Better heat transfer assures more accurate, stable and long-life performance of all components.

FULL PROTECTION
Fusing in the collector of the power transistor protects the supply without affecting regulation.

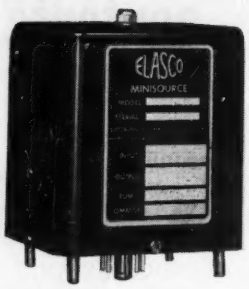
All standard Minisource® power supplies are furnished with an octal glass to metal header (other terminations available upon request) and packaged in a black anodized aluminum transformer case. There is no extra charge for 400 cycles.

SPECIFICATIONS
VOLTAGE REGULATED — FIXED OR SEMI-VARIABLE * OUTPUT

Input Frequency: 60 cps or 400 cps
Input Voltage: 105-125 VAC
Output Voltage: 4 to 200 VDC
Output Current: 50 to 500 ma
Regulation: Better than 0.5%
Ripple: Less than 0.25%
Polarity: May be used Floating, Positive, or Negative
*Screw driver adjustment on top of semi-variable units.



	W	D	H	X	Y	Z
A	3½	3	3 11/16	2 1/16	2⅛	⅜ max
B	3⅜	3⅛	4½	3	2⅜	⅜ max
C	5	4⅛	5⅜	4⅛	3½	⅜ max
D	6 13/16	3 15/16	4 13/16	6	2⅛	⅜ max



FIXED MINISOURCE

MODEL	VOLTAGE	CURRENT	CASE SIZE
M4.5-50	4.5v.	50 ma	B
M4.5-100	4.5v.	100 ma	B
M4.5 250	4.5v.	250 ma	B
M4.5-500	4.5v.	500 ma	B
M6-50	6v.	50 ma	A
M6-100	6v.	100 ma	A
M6-250	6v.	250 ma	A
M6-500	6v.	500 ma	B
M12-50	12v.	50 ma	A
M12-100	12v.	100 ma	A
M12-250	12v.	250 ma	B
M12-500	12v.	500 ma	B
M22-50	22v.	50 ma	A
M22-100	22v.	100 ma	B
M22-250	22v.	250 ma	B
M22-500	22v.	500 ma	B
M25-50	25v.	50 ma	B
M25-100	25v.	100 ma	B
M25-250	25v.	250 ma	B
M25-500	25v.	500 ma	B
M28-50	28v.	50 ma	B
M28-100	28v.	100 ma	B
M28-250	28v.	250 ma	B
M28-500	28v.	500 ma	B
M30-50	30v.	50 ma	B
M30-100	30v.	100 ma	B
M30-250	30v.	250 ma	B
M30-400	30v.	400 ma	B
M50-50	50v.	50 ma	B
M50-100	50v.	100 ma	B
M50-250	50v.	250 ma	C
M100-100	100v.	100 ma	C
M150-100	150v.	100 ma	C
M200-100	200v.	100 ma	C

SEMI-VARIABLE MINISOURCE

MODEL	VOLTAGE	CURRENT	CASE SIZE
V4-50	3-6v.	50 ma	B
V4-100	3-6v.	100 ma	B
V4-250	3-6v.	250 ma	B
V4-500	3-6v.	500 ma	B
V8-50	5-10v.	50 ma	A
V8-100	5-10v.	100 ma	A
V8-250	5-10v.	250 ma	B
V8-500	5-10v.	500 ma	B
V12-500	10-15v.	500 ma	B
V15-50	10-20v.	50 ma	A
V15-100	10-20v.	100 ma	B
V15-250	10-20v.	250 ma	B
V18-500	15-20v.	500 ma	B
V22-500	20-25v.	500 ma	B
V25-50	20-30v.	50 ma	A
V25-100	20-30v.	100 ma	B
V25-250	20-30v.	250 ma	B
V28-500	25-30v.	500 ma	B
V32-250	30-35v.	250 ma	B
V35-50	30-40v.	50 ma	B
V35-100	30-40v.	100 ma	B
V38-250	35-40v.	250 ma	B
V42-250	40-45v.	250 ma	C
V45-50	40-50v.	50 ma	B
V45-100	40-50v.	100 ma	B
V48-25	45-50v.	25 ma	C
V65-50	60-70v.	50 ma	B
V65-100	60-70v.	100 ma	B
V75-50	70-80v.	50 ma	B
V75-100	70-80v.	100 ma	B

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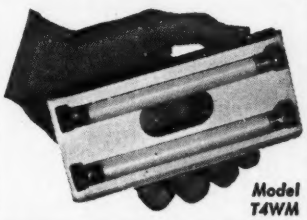

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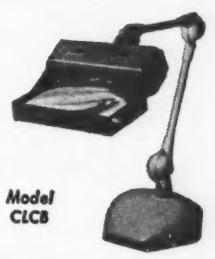

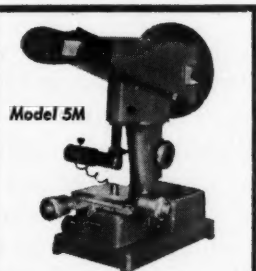

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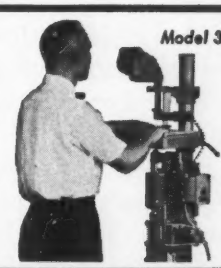
Eliminates need for templates or pantographs. Magnifies the work area, assures precision accuracy, simplifies production, and reduces rejects. Mounts on any drill press or milling machine. Magnifications from 5X to 50X.



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We probably have CUSTOM ENGINEERED and manufactured more special-purpose equipment than any other company in the field. Please indicate the product in which you are interested.

Send for catalogs or outline your requirements in a letter.

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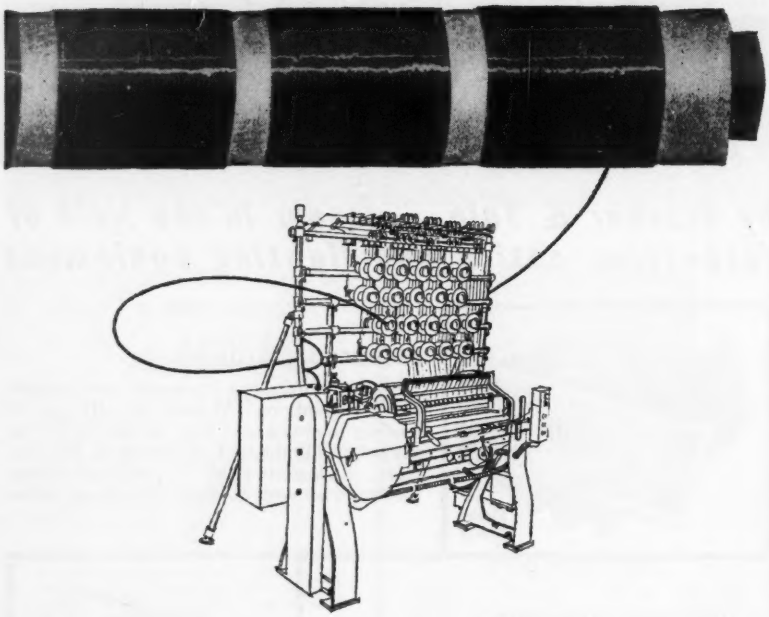

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Leesona Model No. 107

Winding paper insulated coils is faster, more accurate and more economical on the fully automatic Leesona No. 107. *Here's why:*

Electronic control eliminates wire breakage at start-up by gradual winder acceleration. ■ **Paper Miss Detector** automatically stops machine if a miss occurs. This permits one operator to tend several machines. ■ **Windings** are made at speeds up to 2500 rpm on paper inserts from 1⅜" (with short paper attachment) to 23½". A special attachment is available for wide spacing in windings. ■ **Three methods of tension** — strap-type handles wire from No. 19 to No. 42 (B & S); Insto-start over-end type handles No. 20 to No. 44 (B & S). Pot-type wire No. 40-50 (B & S) & finer.

These are just a few of the positive advantages of the Model No. 107 that will help you wind better coils at lower cost. For full details write Leesona Corporation, P. O. Box 6088, Providence 4, Rhode Island.

LEESONA

23B.1.3

CIRCLE NO. 6 ON INQUIRY CARD

Letters

. . . It is about time a magazine devoted to the particular problems of electronic and electromechanical equipment manufacture was published. Good luck on your venture.

Lawrence Price, Specialty Electronics Development Corp.
Syosset, N.Y.

. . . sounds like it might be a major contribution to the industry.

Arnold J. Savitt, Div. Hd., Mfg. Dept.
Hazeltine Electronics Div.
Little Neck, N.Y.

I have just completed reading your latest issue of ELECTRONIC/ELECTROMECHANICAL PRODUCTION (Newsletter) and found it very interesting and especially useful for the electronic production people.

Your subject matter, I believe, will be very much in demand since there are hardly any publications dealing with this specific field. Most existing publications treat electronic production as a minor subordinate area; and consequently, it is very difficult to find information or share any problems that continually arise. Knowledge in this area, up until the present, has been strictly limited to a personal few whose know-how has not been formally defined or recognized in any literature or texts.

It could be that we are now embarking into the organization and recognition of another specialized production area which is the result of our present changing scientific world. Best wishes and success in your enterprising venture.

Joseph V. Smolinski
Assembly Methods Engineering Dep't.
Raytheon Company Waltham, Mass.

Please place Mr. R. Didion, Manager, Methods Engineering, and myself on your distribution to receive your new technical publication, E/E Production, as noted in Number 23 of IRE Newsletter dated October 1, 1961.

The West Coast Division of Radio Corporation of America is engaged primarily in the manufacture of defense electronics. We feel this publication will be very useful in our operation and understand it is circulated to qualified individuals without charge, upon request.

We would also like the first four issues of the Newsletter, if they are still available.

S. Friedman, Manager
Manufacturing Engineering
Radio Corporation of America
Van Nuys, Calif.

. . . Will you please send me a copy of your "ELECTRONIC/ELECTRO-MECHANICAL PRODUCTION" publication, Vol. 1, No. 5, July 1961, as there are certain articles contained therein which have been called to my attention.

S. R. Bryant
Senior Vice President, Production
Engelhard Industries, Inc.
Newark, N. J.

Please send the first four issues of your newsletter and place me on a list to receive it regularly. Also send qualification form to receive E/E PRODUCTION.

Morris B. Frazier, Jr.
Vice President of Engineering
Southern Solid State Electronics, Inc.
Memphis, Tennessee

. . . Would you please send me three copies of Vol. I. No. 5, E/E PRODUCTION Magazine dated July 1961.

J. D. Schiller
Assistant Superintendent
Manufacturing Development
Western Electric Company, Inc.
Winston-Salem, N. C.

Requests such as those typified in the above three letters will be handled on a first-come first-served basis, until the supply of Newsletters is exhausted. If you are planning on binding Newsletters, please send your requests in as the supply is definitely limited. — *Ed.*

. . . I am Chief of the Engineering Electronics Section of the Instrumentation Division, National Bureau of Standards. The section has projects dealing with standardization of circuits, encapsulation, fault location, miniaturization, and the like. Your magazine should prove to be very useful in the Section work.

Gustave Shapiro, Chief
U.S. Department of Commerce
National Bureau of Standards
Washington, D. C.

. . . Your magazine has proven most interesting and I desire to be on your circulation list.

James E. Hilton, Value Analysis Staff
The Martin Company
Orlando, Florida

I have read enthusiastically about your "E/E PRODUCTION" Newsletter and eventual magazine. The information that you propose to present is certainly needed in the industry. . . .

Allston T. Mitchele, Staff Consultant
Maynard Research Council, Inc.
Pittsburgh, Penn.

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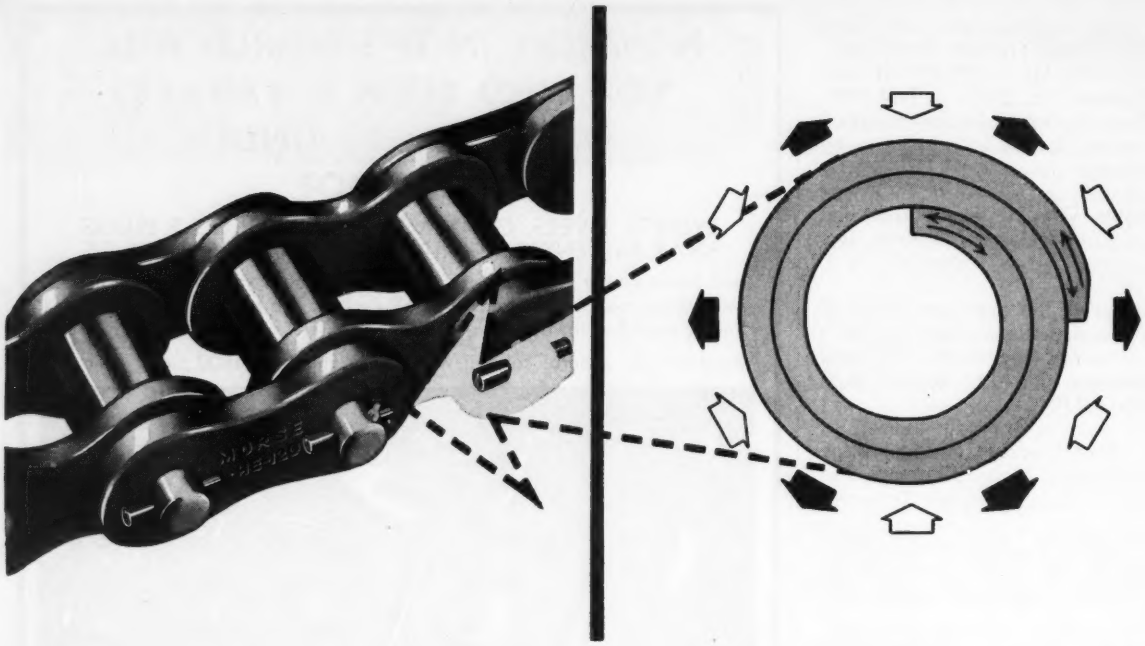
86 FRANKLIN AVENUE, BROOKLYN, N. Y.

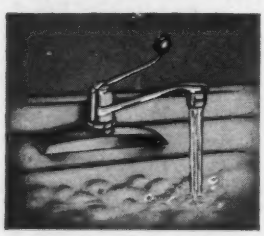
CIRCLE NO. 7 ON INQUIRY CARD



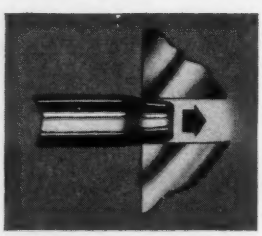
The true spring PIN has real spring *coils*

The spiral coils give SPIROL pins full spring action that is completely different from other flexible pins. Radial stress developed by compression is distributed *uniformly* throughout the spiral coils, — no critical cross-section. This characteristic enables SPIROL true spring pins to absorb high stress and shock, and withstand severe vibration. You gain the maximum benefits of cost reduction and design improvement only when you use a true spring pin with SPIROL's unique, coiled shape.

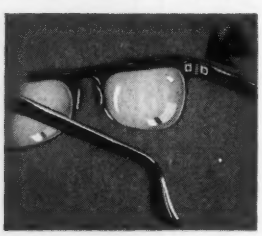
SPIROL coils offer these exclusive advantages



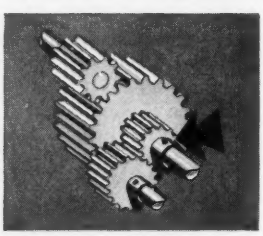
Non-heat-treated metals — such as low-cost brass, copper, nickel stainless steel — can be used in SPIROL true spring pins. Less resilient metals flex without failure, because there is no concentration of stress.



Wider hole tolerances eliminate reaming, reduce drilling rejects, cut production costs. Both plus *and* minus tolerances are allowed because of SPIROL spring pin's greater flexibility in expansion and compression.



Miniature sizes retain flexibility and strength of the spiral cross-section. SPIROL is the only spring-type pin made in miniature diameters: 1/32" — .039" — 3/64" — .052". Standard diameters up to 1/2" in stock.



Shock resistance — extremely high resistance to shock, shear, and vibration permits use of "medium duty" SPIROL pins in the majority of applications. Heavy and light duty SPIROL pins are also available in stock.

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CIRCLE NO. 8 ON INQUIRY CARD

Memo From The Publisher

The increased complexity of manufacturing processes coupled to the economic stress of greater competition compels industry to employ more production personnel with engineering training – particularly in the electronic/electromechanical manufacturing areas where Lilliputian components generate Brobdingnagian production headaches. Management can no longer fail to recognize that intuitive decisions dependent upon experience or observation alone must give way to more objective procedures founded upon modern industrial engineering principles.

Yet basic principles are only the foundations on which we build. The ingredient that separates the men from the boys – call it "Yankee ingenuity" if you will – is the manner in which these basic principles are applied. Although designs may be standardized for all companies making a given product (especially military), production techniques rarely are or can be. Thus, one company may spurt ahead and capture a market because of some production innovation.

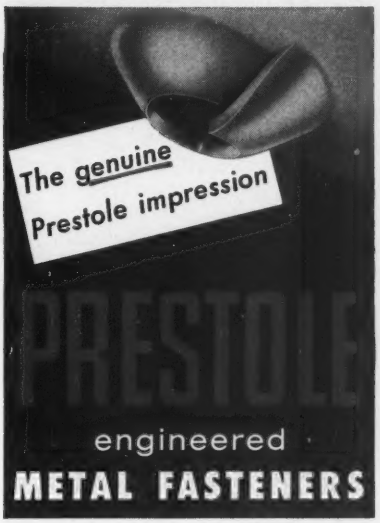
To achieve his highest degree of fulfillment, the production engineer must possess a very large "bag of tricks". A new tool, a new material, a new component may spark the creative idea that leads to the solution of a problem. In the electronic/electromechanical industries, manufacturing engineers have been particularly handicapped in having to research many sources for information as to the *availability* of tools, materials and components which could mitigate their production problems.

This magazine, ELECTRONIC/ELECTROMECHANICAL PRODUCTION, will be the first publication to service *exclusively* the needs of manufacturing, production and industrial engineers working in this industry. Toward this end we ask your assistance. Your comments, kudos or criticisms of this issue and the others to follow will be welcome.

George Palken

Publisher

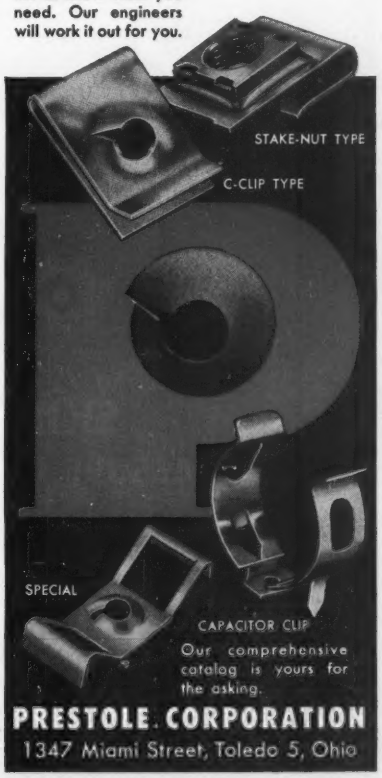
THE IMPRESSION THAT LASTS



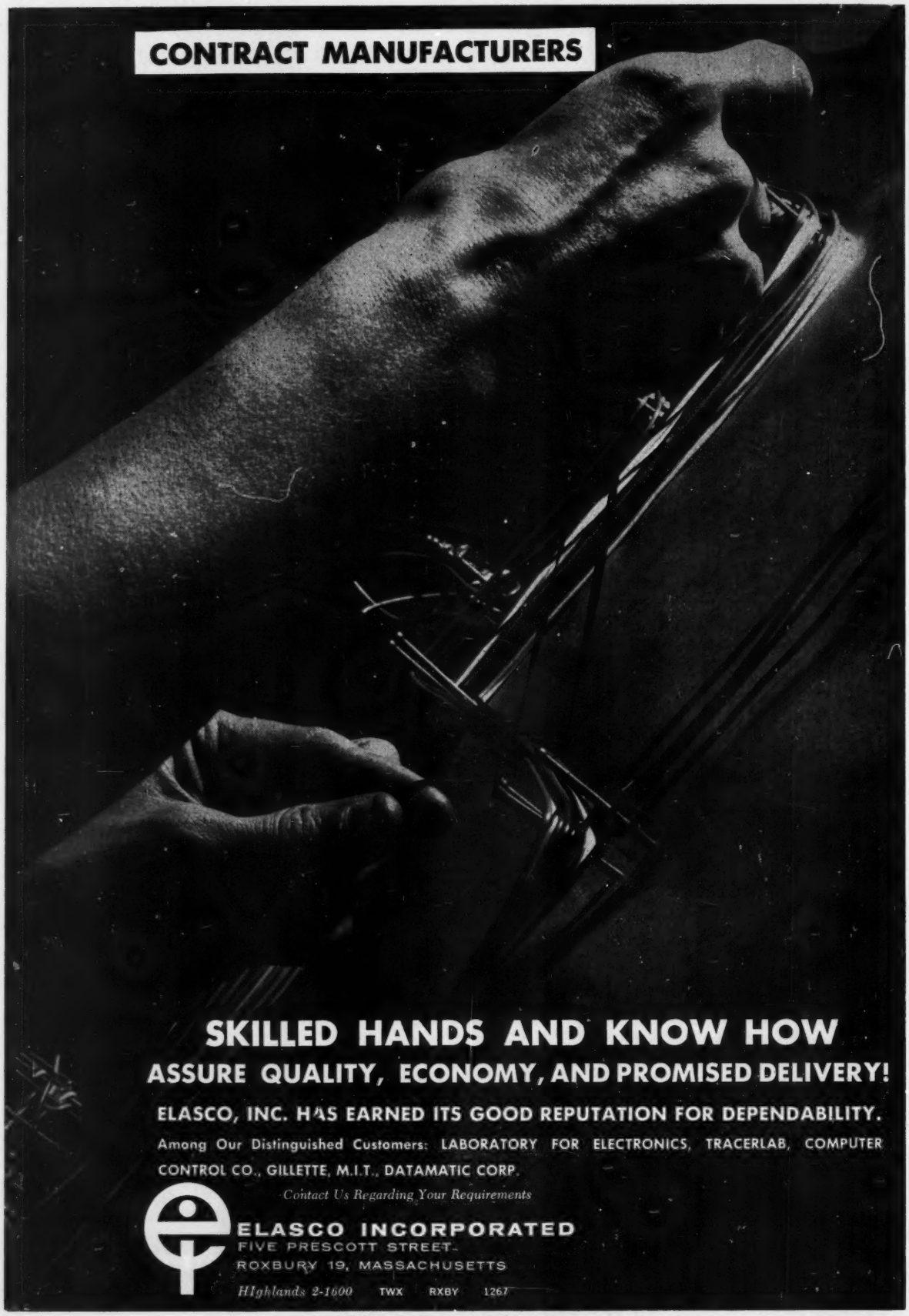
for the Automotive, Appliance, and Electronics Industries

The genuine Prestole impression, engineered to conform to the helix of the screw, uses the known geometrical strength of the truncated cone. That is why Prestole fasteners have greater tensile strength, greater holding power and will withstand more torque than any similar fastener on the market.

Let us know what you need. Our engineers will work it out for you.



CIRCLE NO. 9 ON INQUIRY CARD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ASSURE QUALITY, ECONOMY, AND PROMISED DELIVERY!
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CIRCLE NO. 10 ON INQUIRY CARD

Welcome to the first issue of ELECTRONIC/ELECTROMECHANICAL PRODUCTION.

prospectus

And we say "Welcome" not to strangers but to you about whom we know a good deal – professionally: we know your titles, we know your product lines, we know your geographic distribution, we know the plants you work in, we know your job functions. We not only know these facts about you as a group of manufacturing, production and industrial engineers in the electronic/electromechanical industries–you can see some of this data tabulated on the next page – , but we also know these facts as they apply to you individually.

How do we know all this? You told us.

Last January we started the mailing of questionnaires similar to the one facing the inside back cover (to date we have mailed over seventy thousand). From those that were returned to us, we selected your name based on the information you submitted and added you to our growing circulation list. Then starting in February we mailed you a monthly newsletter of the same name as this magazine so that we could keep in touch with you, should you move or change jobs.

In the meantime the information you gave us was punched into Univac cards containing scriptomatic stencils for retrieval, analysis and tabulation. For example, from a group point of view we know how many of you build synchros or television sets or transducers or appliances or instruments or computers or any one of 88 product lines. We can reach all of you – by name – who build a specific or generic product line. We can query you on your problems; we can amass non-proprietary statistics associated with your production complexes; we can collect and tabulate the kind of information you tell us you need to solve your problems. And we have begun to do this, and more.

Our approach to locating you, qualifying you, selecting you, and analyzing your needs and organizing to serve them is unique in the history of the engineering and scientific press. Never before has a circulation list for a publication been selected by a qualification system based on an analysis of a job title, job function, products manufactured and number of production personnel. Never before has all this information – and more – been stored on a retrievable basis for the purpose of serving the reader so selected. Never before has the editorial staff of a magazine, in our case all men who have earned their living as engineers, been so informed about the audience they will serve. Never before has a crystal ball been so thoroughly shattered in publishing. All of this before the first issue of a magazine has been published.

"So what?" you may say. What's this mean to me?

Here's what. Based on the information you gave us our staff has begun an immense research project, collecting and organizing information that we know will be of maximum use to you. In the months to come we shall be publishing definitive and comprehensive surveys and tabulations that will enable you to make faster and faster decisions with respect to the selection of tools and methods – amidst conflicting management philosophies – in the production of E/E components and systems. Throughout these compendiums our editors will be inspired by three passions: to learn as much as possible about your problems; to gather as much specific information that will help you to solve them; and to present the collected material in the manner that will help you solve your on-the-job problems in production and the management of the production functions.

Should we be successful there will be no better body of authoritative knowledge in the field of E/E production and no better single source of up to date, continuing production and production management education.

Of one thing you can be violently sure: your future contains production and production management problems. The production function in the E/E industries has changed more in the past fifteen years than in any other branch of engineering, in staff needs, methods and results. Indeed, successes and failures in these industries will be attributed more to production than to design in the highly competitive years to come. Your major responsibilities in production is what we have accepted as our editorial function and coverage.

So "Welcome" to E/E Production: *today's* textbook that contains solutions to *today's* production problems.

Harold C Burkhart

Editorial Director

Number of Prod. & Mfg. Engineers	Making This Kind of E/E Product	In This No. of Prod. Lines
261	Accelerometers	73
419	Alarm Systems	103
102	Alternators	51
151	Altimeters	32
1305	Amplifiers	283
401	Antenna Systems	75
582	Attenuators	106
20	Batteries	14
211	Bridges	68
1208	Cable & Wire Assemblies	214
171	Calibrators	58
1180	Capacitors	281
816	Chokes	184
219	Choppers	38
1814	Circuit Elements (R-C-L)	391
981	Circuits, Printed	182
216	Clutches & Brakes	42
716	Coils	242
916	Communication Systems	171
1314	Computers	234
201	Connectors	184
3164	Control Instruments	491
1161	Converters, Anal. to Dig.	221
742	Converters, Frequency	148
83	Counter Measure Systems	18
468	Counters (Except Radiation)	152
93	Counters, Radiation	58
748	Data Processing Equip.	165
106	Delay Lines	46
103	Direction Finders	61
208	Electro-Optical Equip.	62
783	Filters	289
109	Fire Control Systems	69
43	Flight Control Systems	18
18	Fuses	8
394	Generators	162
156	Guidance Systems	72
189	Gyros	67
34	Infrared Equipment	16
206	Input-Output Devices	81
193	Instrument Landing Systems	41
3412	Instruments	481
94	Integrators	28
286	Inverters	141
193	Lamps and Lights	62
22	Medical Equipment	14
394	Memory Devices & Systems	55
1212	Meters	206
94	Microphones	34
72	Modulators	35
384	Motors, Fractional	122
282	Motors, Integral	116
104	Multipliers	34
212	Navigation Systems	126
22	Nuclear Instruments	18
415	Oscillators	260
42	Pilots, Automatic	34
206	Potentiometers	81
1630	Power Supplies	460
178	Production Machinery	131
482	Radar Equipment	114
693	Radio & TV Sets	112
290	Receivers	216
143	Recording & Playback Equip.	98
162	Rectifiers	91
243	Regulators	163
653	Relays	215
48	Resolvers	24
1620	Rotating Components	489
433	Solid State Devices	174
784	Switches	292
36	Synchros	18
206	Tachometers	103
34	Tape Transports	16
212	Telemetering Equip.	64
489	Temp. Sensing Devices	294
203	Timers	106
106	Transceivers	78
2142	Transducers	498
2640	Transformers	577
230	Transistors	42
314	Transmitters	114
1986	Tubes (All Types)	158
22	Ultrasonic Equipment	18
116	Valves (Servo & Solenoid)	88
48	Weapons Systems	22
52	X-Ray Equipment	36
1643	Other (Industrial and Consumer Appliances)	241
47,489		12,220

HOW TO INTERPRET THIS CHART

From the above 88 product lines, readers, in filling out our qualification card, could pick no more than five. The left-hand column total of 47489 represents 15,168 readers working on an average of approx. 3 products. Right-hand column total of 12,220 represents approx. 4000 plants for an average of 3 production lines per plant.

JOB FUNCTIONS	NO. OF READERS*
PRODUCTION PLANNING & MATERIAL CONTROL	2303
PLANT LAYOUT	1115
VALUE ANALYSIS	2452
DESIGN FOR PRODUCTION	7046
MANUFACTURING & PRODUCTION METHODS	7780
PRODUCTION TESTING	2654
MATERIAL HANDLING	840
PRODUCTION DATA PROCESSING	828
RELIABILITY & QUALITY ASSURANCE	3794
WORK MEASUREMENT	1085
OPERATIONS RESEARCH	1176
INDUSTRIAL ENGRG. INSTRUCTION	377
PURCHASE ENGINEERING	1814
MATERIALS TESTING	898
OTHER	724

*15,168 readers perform a total of **34886** job functions.

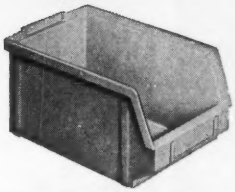
Have YOU Told Univac What You Do?

If you haven't, you are not on our circulation list. For your complimentary subscription to this publication you must be a production, manufacturing or industrial engineer or executive working in a plant making one or more of the products listed in the qualification form facing Page 1. Follow instructions in filling out and mailing the form.

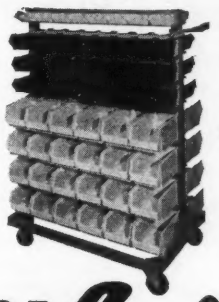
E/E PRODUCTION Starts as a monthly with the next issue: January, 1962

Lewis UNITIZED ASSEMBLY CONTAINERS

FOR
- ASSEMBLY
- PRODUCTION
- STORAGE



Lewis Plastibox containers are one-piece molded plastic. They are smooth, strong, non-corrosive, easily cleaned. Colors, either green or yellow, are molded-in. Plastibox containers stack securely and afford maximum storage of small parts. Sizes available are 8½" long x 5" wide x 4½" deep, 6" x 3½" x 2½", 3" x 3½" x 1¾", and 3" x 3½" x 1¾" with a vertical divider.



MOUNTING RAILS— Rails are supplied in 18" and 36" lengths to mount 4 or 8 of the 3 smaller size Plastibox containers; 3 or 6 of the largest size. Rails afford a wide variety of bench or wall arrangements for any assembly or storage operation.

MOBILE TRUCK ASSEMBLY — These Lewis trucks handle all sizes of Plastibox containers and allow the boxes to be quickly and easily moved from one area to another. Trucks furnished with 36" mounting rails, two swivel and two rigid casters, and are finished in grey enamel.

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ARNOLD/TOROIDAL COIL WINDER

sets up quickly...easy to operate... takes wide range of wire sizes

SPECIFICATIONS:
- Min. finished hole size: .18 in.
- Max. finished toroid O.D.: 4.0 in.
- Winding speed: 1500 turns/min.
- Wire range: AWG 44 to AWG 26
- Dual, self-checking turns counting system
- Loading (wire length) counter
- Core range: ¼" I.D. to 4" O.D. to 1½" high

LABORATORY USE
- Change wire and core size in 45 sec.

PRODUCTION USE
- 1500 turns per minute
- Insert core and load in 20 sec.

$1200.00 *includes all rings, counters and accessories*

immediate delivery. literature on request

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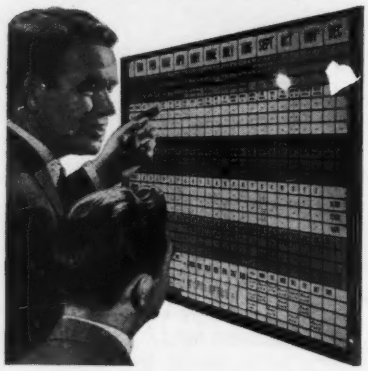
CIRCLE NO. 34 ON INQUIRY CARD

How To Get Things Done Better And Faster



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CIRCLE NO. 12 ON INQUIRY CARD

Production Insights

S. Henry Sacks, Managing Editor

Widespread use of printed wiring to bring down the size and weight of subsystems for airborne equipment has reached a level where cause and methods of failures have become important enough for serious test and evaluation. Fatigue strength of printed wiring and the associated through-connections are the points at which these boards can exhibit failure, particularly when subjected to vibration associated with aircraft and missiles. G. R. Gohn and A. Fox of Bell Tel Labs have developed a technique for studying fatigue strength of these boards by means of a plate testing machine coupled to a monitoring system that indicates failure when an open circuit of three millisec duration occurs. Their system can be modified to respond to open circuits of shorter duration.

Gohn and Fox presented their data – plots of strain versus life – for copper-clad laminated epoxy-glass boards containing various types of through connections. Strain rather than stress was selected as a parameter because at the vibration amplitudes to which test specimens were subjected strains in the conductors were in the plastic region. Gohn and Fox also collaborated on developing a limited creep test device that delivers basic information on the permanent tightness of solderless-wrapped connections, riveted assemblies, shank fits and similar devices. Stress-relaxation data obtained from these tests can be used to develop stress relief treatments that may be used to even out stress concentrations resulting from geometrical factors and non-uniform loads in the working parts of various designs under stress.

MARRIAGE OF METHODS

Every production manager dreams of the ideal product: one model – and only one model – that can perform all of the requirements of the several hundred to several thousand models that they must build and stock to serve the needs of industry. T. R. Hays of RCA Semiconductor & Materials Division tells us that RCA has been searching for a universal transistor that could perform all of the functions that the more than 2,000 transistor-types now on the market deliver. While they haven't been 100 percent successful, they have come up with a development that will cover about 40 percent of combinations of power, frequency and energy required by most of the circuits. Designated 2N2102, RCA's new transistor owes its virtuoso performance to a newly perfected manufacturing technology. Said Mr. Hays, "We have succeeded in wedding triple diffusion and planar manufacturing techniques, both relatively new and highly exacting processes, in a single transistor. Along with other techniques, they have combined to give the 2N2102 phenomenal powers for amplifying, switching or regulating current flow – the primary areas where transistors are used. In addition, they afford the device great electrical stability and reliability."

Mr. Hays' statement points out the importance of putting design engineers together with production engineers so that, working as a team, these men can reduce existing headaches suffered by equipment manufacturers in maintaining adequate and sufficiently diversified inventories of a wide variety of models to meet the wide range of performance parameters associated with any particular piece of equipment. Concentration in these areas – reducing the number of

models or types of a component or subsystem while extending performance ranges — is bound to increase as management works on the problem of decreasing costs and increasing profits.

RESEARCH ON PRODUCTION PROBLEMS

If you have some rather sticky production problems, you might check with the U.S. Department of Commerce's Office of Technical Services to determine whether they have spent any time and money studying that particular problem, or any aspect of it, before you decide to undertake a study of your own. For some time major emphasis in government-sponsored research and development centered on the design of various devices; over the past number of years production problems have been enjoying a fair share of these budgets. Two latest reports involve production problems in the manufacturing of explosive switches and cooling of electronic packages.

In the first report, the Atomic Energy Commission tells how a production problem in the manufacturing of explosive switches was solved by the use of quality control techniques. They found that failure occurring in an explosive switch following a major material change was not due to the material change but to a change in the design of a form tool that performed an internal finish cutting operation on the switch housing. Reversion to the original tooling design eliminated the failure.

AEC's technique was quite thorough and involved these major steps: chemical and physical analyses of raw materials; batch and tooling identification of piece parts; inspection of piece parts to assure their conformance to specifications, using statistical acceptance sampling and control chart techniques; feedback of piece part acceptance information to subcontractors; in-process inspection using control chart techniques; periodic inspection of tools and gages; accountability of all piece part batches comprising the final product; final acceptance testing to assure that the product meets the design requirements; statistical evaluation of functional test data. Ask for OTS report SCTM 67-61-13, (50 cents) from OTS, U.S. Dept. of Commerce, Wash. 25, D. C.

In the second report, the Army showed that the size limits of electronic packages cooled by thermal conduction can be significantly increased by placing auxiliary thermoelectric refrigerator units in the package walls. The study compared three types of cooling; thermoelectric cooling elements, simple thermal conduction and a combination of conduction and thermoelectric refrigeration. They found that package structure can cool packages of considerable size by thermal conduction through the structure members when the whole package is effectively designed; cooling by thermal conduction with auxiliary thermoelectric refrigeration permits marked increases in package sizes and volumetric heat-release rates. It was also found that extending thermoelectric cooling elements from the package walls to the interior is virtually useless except for very small packages. Ask for PB 171 540 from OTS. Cost is $1.00.

CUTTING IT THIN

Rescon Electronics Corp. of Waltham, Mass. has developed a new technique for the economical production of thin-film microcircuit elements. Their new technique, "serial manufacturing", produces higher yield and closer tolerances than existing methods of fabrication according to company engineers. Explaining the production method, Rescon pointed out that serial manufacturing means each circuit element is individually produced and monitored to its proper value, lending itself to automatic control and resulting in increased accuracy and reliability, according to I. L. Brandt, Rescon's manager of microminiaturization and special tube division.

Said Mr. Brandt, "Our system eliminates the dependence of yields on component density, permitting us to fabricate complex thin-film microcircuits with the same degree of precision that would result if we were to make only a single component. Increased yields we are able to obtain effect a sizable reduction in cost." Brandt expects that the new technique will accelerate the adoption of thin-film circuit assemblies by the computer and electronics control industries where high costs have been a major obstacle to their large scale acceptance up to now.

300% FASTER ULTRASONIC CLEANING*

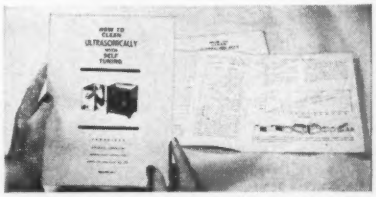
WITH THE NEW SELF TUNING AUTOSONIC BY POWERTRON

Powertron Autosonics are the only cleaners that continuously tune themselves electronically to give you peak cleaning efficiency. Regardless of load changes, liquid level, liquid temperature, or operator inattention, you get top cleaning performance hour after hour with no controls other than a single switch

The Powertron self tuning feature is available in a complete line of Autosonic tank units, consoles, cabinet models, immersible transducers, and vapor degreasers that . . .

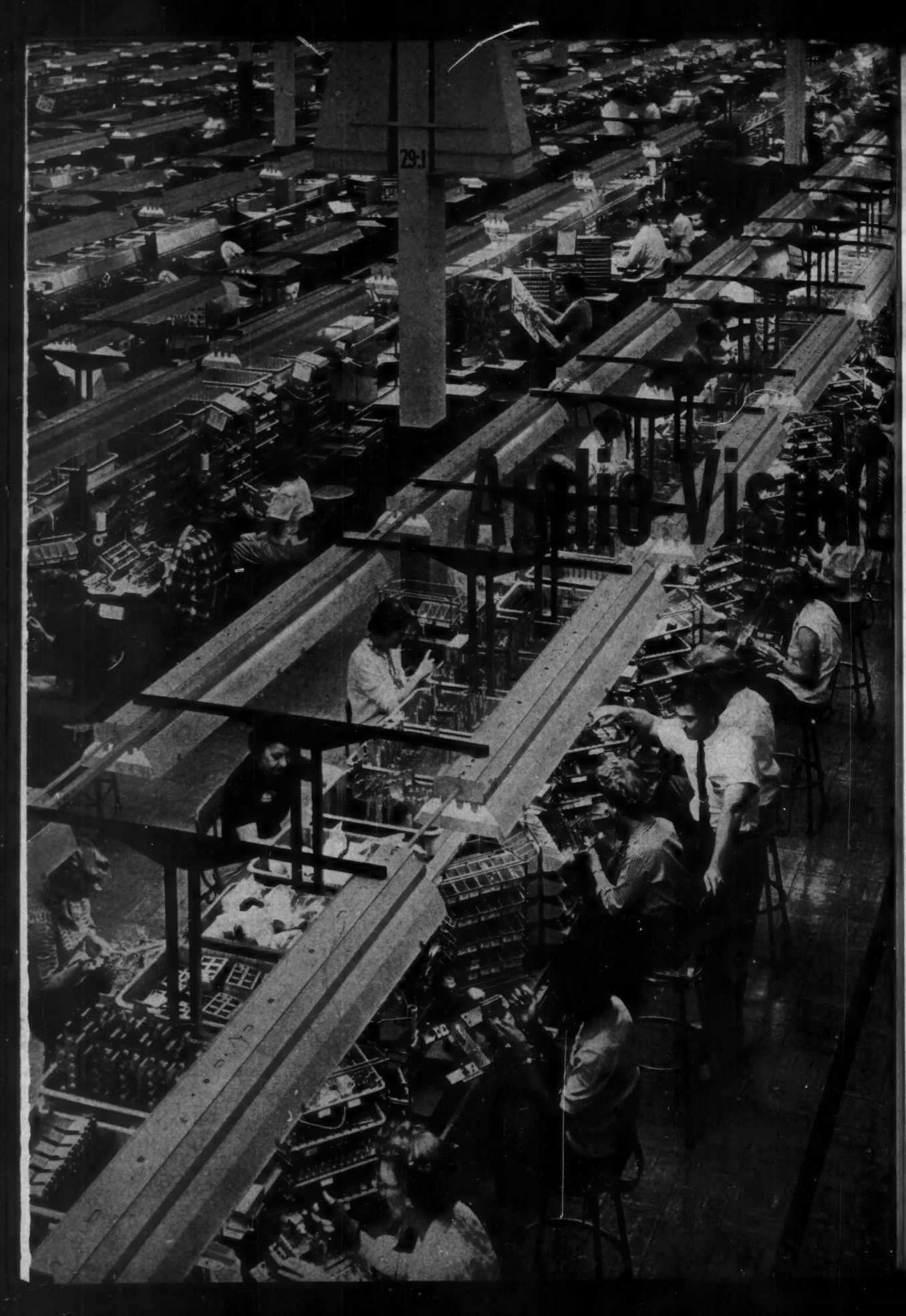
ELIMINATE OPERATOR TRAINING AND MONITORING
IMPROVE QUALITY
REDUCE REJECTS
CUT LABOR AND SOLVENT COSTS

*Case histories on file show up to 900% faster cleaning consistently and savings as high as $3,000 a month in labor costs under ideal conditions.



Send for Powertron's free booklet 60-1, "How to Clean Ultrasonically with Self Tuning." Write Dept. E/EP-9

POWERTRON ULTRASONICS CORPORATION
DEPT. E/EP-9 • EXPRESSWAY INDUSTRIAL PARK
Plainview, L. I., N. Y. • GE 3-9600
CIRCLE NO. 13 ON INQUIRY CARD


29-1

Provide total recall with the double-barrel impact of sight and sound
Assure accurate compliance with every step of a task
Decrease learning time by as much as 75%
Reduce need for highly skilled personnel
Completely standardize procedures
Increase production by an over-all average of 50%
Reduce defect rates by 55%
Eliminate "Opinionized Quality"

Production Aids

Evaluation of these new tools indicates a significant breakthrough in handling complex manual assemblies.

Application of audio-visual tools as a systematic approach to manufacturing is relatively new; evaluation of their use, as an ideal means of converting engineering data to manufacturing language then communicating this to the production worker, is underway in many companies. In-production experience gained thus far indicates that electronic assembly, inspection and testing, quality control and personnel training are among the most successful applicants for A-V techniques.

TECHNIQUES & TIME IN TUNE

Hughes Aircraft Co. not only produces commercially available audio-visual equipment (known as Videosonic) but they are, presently, the largest user of A-V units, with over one thousand in use in their El Segundo, Fullerton and Tuscon Divisions. Commenting on the development of A-V at Hughes, Jack Wood, Ass't. to the Works Mgr., El Segundo Div., reminisced with horror at the complexity of assembly work that initially triggered their need for a more efficient control of the flow of techniques and materials through men and machines into final product realization – "8-10-16 hrs. of work on an item before it can be passed on" – "memory of work stages became impossible" – "written instructions no longer valid" – "too much misinterpretation" – "frustration rampant" – "costs up" – "shift changes a major problem".

Lack of proper communications was a basic problem in pre A-V days, according to Jack Berry of Hughes' Fullerton Div. He characterized A-V as an optimum tool for "telling the girl what to do when she needed to know what to do"; also, "A-V gives just the right amount of time to do the job".

Does your particular item, assembly or process lend itself to A-V programming? Of course, the answer requires a complete analysis of your specific situation; however, there are some general rules for determining whether an item qualities as a successful candidate for A-V.

Here are some of these qualifications, based not only on Hughes' experience, but also from evaluations made by General Dynamics/Pomona, and Laboratory For Electronics. Before using A-V methods, the Applied Manufacturing Res. & Dev. Dept. of General Dynamics/Pomona prepared an excellent evaluation study, under the direction of A. H. Dunn, Dept. Mgr. and R. A. Girvin, Operations Research Group, based on complete on-premises testing of A-V planning, implementation and production, tied into a complete cost analysis. Robert Baker and William Hart, Supervisor and Member respectively, of LFE's Work Measurement Section of Manufacturing Engineering, are now in the process of setting up complete A-V work stations for assembly, testing and personnel training. (It is interesting to note that of the dozen or so companies that have been reported as using A-V techniques as a systematic approach to production, LFE is the only one located east of the Mississippi.)

GENERAL CRITERIA

1. Manual assembly — item must be planned for manufacture by manual assembly operations rather than by automatic machinery.

Hughes incorporates their Videosonic unit into their standard work station. Separate base and super structure can be augmented with more than 30 basic components. Typical work station, with tools and tool holders, parts bins, fixtures and jigs, electrical outlets, chair or stool and other necessary accessories, commercially available from the Industrial Systems Division of Hughes, sells for approx. $275. Together with a Videosonic unit or approx. $595 this gives a total of $870 for a complete Hughes' A-V station. According to Hughes, complete stations are available with immediate delivery.

2. Complexity — it's obvious that A-V contributes its greatest value on long, complex operations where the normal learning process is slow, thus using to the highest degree, A-V's most productive benefit – decreasing (or eliminating) the learning time. General Dynamics/Pomona reports that, generally, there is an agreement among users that no task less than 1 hour should be scheduled for A-V.

Obviously, there is not much to be gained by applying A-V to jobs that can be completed in 5 minutes since it could hardly shorten learning time sufficiently to justify the expense of installing the program. Exact minimum time fluctuates with complexity of the item, number of units in the production run, quality required and other factors. For example, General Dynamics/Pomona points out, with a very short production run (25 units), it's quite possible that A-V would be valuable even though the task's operation time is only 20 minutes, if the quality level is critical or it appeared profitable to preserve the planning for later runs. By the same token, a 40 minute task composed of a series of simple operations may not justify an A-V program.

It is difficult to arrive at a maximum operating time; generally, the longer the assembly time, the more suited the item is for A-V. There is at least one example of using A-V on an assembly requiring 160 hours to complete. This job requires several instruction tapes and numerous slide magazines but the changing of tapes and slides, by the operator, is an easy task.

3. Size — normally, use of A-V requires that the assembly be relatively small. Large jobs, requiring excessive movements outside the limits of the standard A-V work station, are not usually considered A-V candidates. However, by putting more emphasis on aural instructions and using the visual illustrations for periodic reference, Hughes has used A-V quite extensively in assembling large harness boards. As General Dynamics/Pomona's study points out, if those responsible for the planning recognize the situation and prepare adequate instructions then size will not seriously affect the value of A-V.

4. Production Quantity and Rate — No clear-out answers have been reported as to what minimum or maximum production quantities should be considered practical for an A-V program. As a general guide, the production quantity should be large enough to justify A-V planning costs but small enough to make the "Unit Build" method more economical than a balanced "Line Flow" setup.

Maximum quantities depend mainly on production rate.

Over 1000 Videosonic work stations are in operation at Hughes Aircraft Co. Typical areas where Hughes' Videosonic system has found its place as a useful and invaluable tool are (a) detailed fabrication and assembly planning instructions, (b) operations analysis, (c) operating procedures, (d) forms instruction, and (e) training and orientation situations. Initial implementation of Videosonic equipment at Hughes was on electronic assembly lines. Using less skilled operators than previously employed, production increased an average of 35 percent over that experienced through the method of detailing procedures or instructions in written form. Instructions can be programmed and paced to a realistic standard, assuring maximum output. Provisions are made for easily stopping, reversing, and reactivating tape instructions in the training of new and inexperienced people. By eliminating the necessity of interpretation of instructions and decisions, rigid adherence to established procedures and specifications is assured. Hughes reports that the Videosonic system guarantees quality and improvement of the learning rate while expanding the scope of supervision.

General Dynamics/Pomona's study indicates that where the quantity is large and the production rate high, the value of A-V has not been determined to any satisfactory degree. One manufacturer uses A-V to establish pilot line production and continues the A-V setup until main production (by line-flow) is in operation. When the main production tapers off due to nearing contract completion, the A-V setups are re-activated and continued after main lines have shut down.

Most experience to date suggests that A-V has greater application to small production contracts. Under the normal learning process, the operator is not expected to reach a high level of efficiency until he has completed a large number of identical units. With non A-V methods, the individual must first become familiar with blueprints and written instructions and then he must discover and master the best techniques to do the job. A-V takes care of all this in the planning of tapes and slides thus greatly reducing learning time; the operator reaches top efficiency rapidly. However, in applying this to long production runs, A-V does not generally retain this advantage indefinitely. At some point, both methods (non A-V and A-V) reach a maximum of production realization, and normally this maximum will be the same for both methods. There may, however, be situations where A-V gives efficiency that would not otherwise be realized.

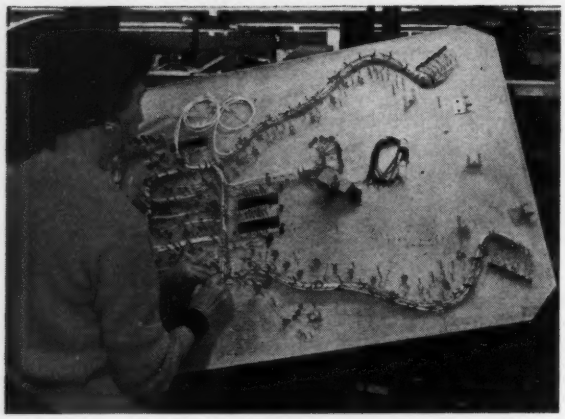
Then too, you have to take into account indirect advantages that may warrant use of A-V even in large production runs. Some of these advantages, reported by Baker and Hart, LFE Electronics, Div. of Laboratory for Electronics, Boston, Mass., include:

- Standardization of well planned methods, no deviations in sequence of work, no omissions.
- Reduction in personnel turnover (doing a complete job builds worker interest and gives a sense of accomplishment usually not present in line methods).
- Greater flexibility to meet problems of absenteeism and turnover (this, of course, is due to the reduction in learning time).
- Elimination of "Fire-Fighting" – complete program packages (tapes and slides) approved by Quality Control before any production eliminates differences in quality criteria between production supervision and Q. C. personnel.
- Increased efficiency at inspection – assembly and inspection are using the same slides for quality reference.
- Reduction in production engineering delays during production – problems are worked out as the job is being programmed, before the work reaches the floor.

Model 202 Videosonic unit, made by Hughes Aircraft Co., Industrial Systems Division, L. A., Calif., automatically presents a planned series of color slides in synchronism with aural taped instructions. Approximate cost is $595.

SIGHT & SOUND IN SEQUENCE

With A-V, the production worker's task is tremendously reduced. Technical information, assembly sequence and special production techniques are presented to the assem-



Although A-V techniques are usually applied to smaller assemblies, Hughes also uses A-V in the construction of large harness boards by putting emphasis on the aural instructions with periodic reference to the slides.

bler in tape and slide form requiring a minimum of mental effort or decision. Since the operator has no other information available other than that given by the audio-visual unit, the sight and sound instructions must be accurate and complete in every detail.

Many specific methods and techniques of preparing an A-V program have been applied successfully. Planning for an A-V program is generally of higher order than that of conventional methods. Generally, as the first step, the planner prepares a detailed "script". Next, the actual work is assembled under the planner's step-by-step instructions, and photographs are taken showing the various steps in the assembly. Then the photographic slides are prepared. Audio tape and 35mm slides, okayed by Quality Control, are now ready for the production floor.

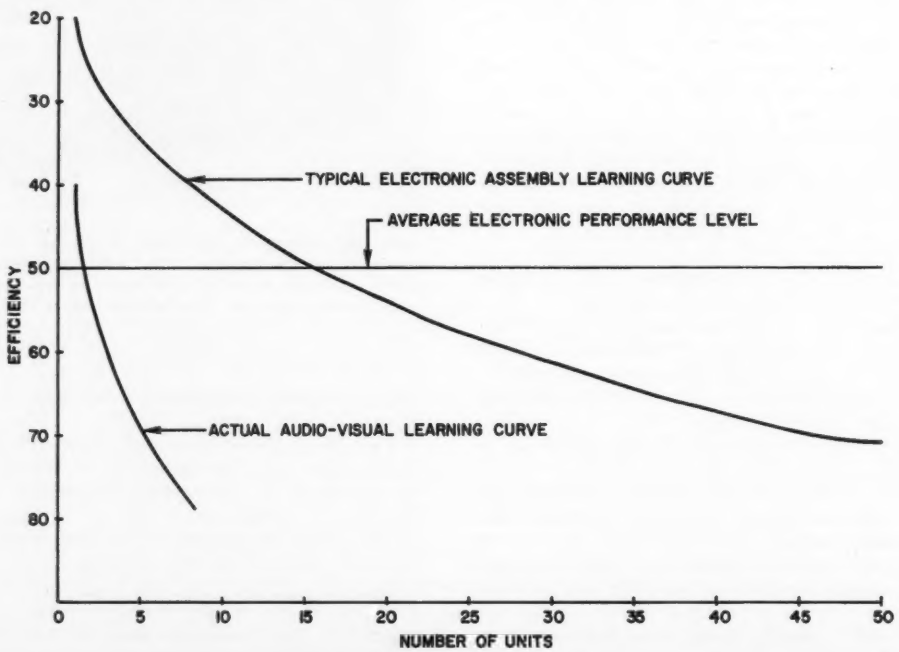
DEMAND VS. PACED TAPE

Two basic tape preparations, in A-V, are called the "paced" and the "demand" tape. Ideally, with the paced method, the tape never stops. Instructions are so timed that the worker has time to complete each operation before the next instruction. If spacing is insufficient, the operator can stop the tape and finish that particular operation. Several methods can be used to determine the amount of time between instructions. One method of timing is based on a "better-than-average" worker building the product; another method assigns specific calculated times based on standard time and motion studies. In either case, the "paced" tape does not penalize the slow worker since there is no way to speed up the tape.

Use of several different versions of the same tape, each in lessening degrees of detail, provides a method of accommodating to increased worker proficiency. LFE Electronics uses three variations:

- "Regular tape" for inexperienced operators.
  Example: "Obtain R1, orient so that lug is at left insert in bottom hole."
- "Abbreviated tape" for experienced assemblers.
  Example: "Obtain R1, assemble".
- "Bikini tape" for use after experienced operator gains high proficiency.
  Example: "R1", "R2".

Requiring a different philosophy of operation, the second method of tape presentation is termed the "demand" tape. Here the operator literally demands instructions at her own pace. Tape automatically stops after each instruction and remains stopped until operator presses, for example, a foot switch. Time rate is not fixed with this method; each operator can work at the peak of her ability.



Typical comparative learning curves

An excellent example of using only audio instructions is LFE Electronics' method of handling their cabling operations. A conventional Dictaphone unit instructs the operator by "demand" tape. Cable board is designed as a road map with a different color for each leg or street. Instructions refer to the colored streets to identify location of work.

Typical instructions:

Lead #74 to orange street #86

Lead #32 to purple street #53

Color description of the lead termination creates an immediate response thus reducing search time. A new employee, trained in the fundamentals of cabling, has been able on her third cable, to equal assembly time of an operator who has been building the same unit for three years.

Choice between using the "paced" or "demand" method can be determined by weighing such factors as the value of a controlled production rate vs. the non-controlled yet continuously adjustable rate; value of "paced" method compared to its higher costs of time and materials; and the value of a continuous time and motion study. Each user will find certain advantages in each system.

Voice, music, warning tones and slide tones are other audio considerations. Important voice factors are diction, enunciation, clarity and the authoritativeness of tone. The question of whether to hire a professional voice or to use a qualified employee is one that has divided opinion. Hughes feels that a specialist that gives a professional tone is advantageous while other users believe that familiar employee voices are more effective.

Background music is said to promote A-V acceptance by the worker and increases productivity. For the small group that finds music distracting, or dislikes music, it can be eliminated by turning off the appropriate amplifier. Industrial music suppliers offer music by wire, radio or tapes.

A very practical method is the use of a master tape as a source of copies and for effecting information change. Common practice of recording only one side gives the advantage of not introducing discontinuity on the other side, when splicing is necessary. After completion of a production run, the master tape, reflecting all the technique modifications, as well as the engineering state-of-the-art, can be stored for future production.

SLIDE PREPARATIONS

Visual instructions, in synchronism with audio portion, consist of 35mm slides projected on a 9" by 12" viewing screen.

Complexity of operation dictates the ratio of the number of audio instructions per slides; 6 to 8 instructions per slide appears to be typical. Too many slides would be wasteful of worker's time and photographic materials while too few slides might lead to quality reduction.

Colored slides, proved to be superior to black and white, give better orientation, identification of items and a more realistic comparison between the actual item and the picture. Investigations of color and black and white indicate that cost is about the same.

Automatic slide-changing is considered one of the basic elements of A-V. Methods of obtaining the slide change signal vary; the most prevalent method is a selective circuit operating on a specific frequency tone carried on the same track as the audio instructions.

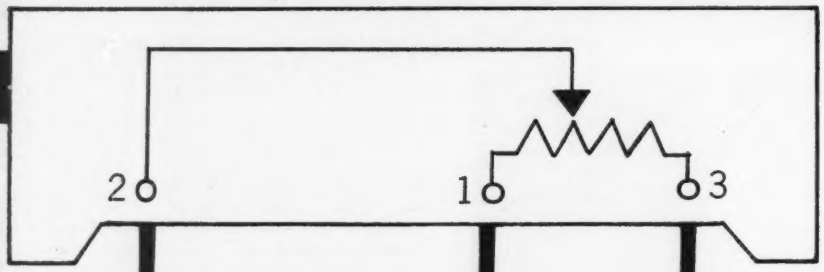
GENERAL COSTS

Typical capital investment runs approx. $1000 per work station (includes A-V unit and work table, bins, fixtures, tools and accessories) and $5000 to $8000 for studio equipment. Implementation costs are based on approx. 20 to 30 hours of planning per hour of production tape. To arrive at a total amortization rate, the direct labor savings should be considered and added to the beneficial results of other phases of production such as quality and reliability, sustaining engineering, inspection, supervision, etc. This amortization rate of capital equipment becomes effective after sufficient units are built to overcome net implementation cost (the additional expense of A-V programming over and above the conventional straight written planning method).

Results obtained at Hughes show that this additional operating expense is usually recovered by the savings in direct labor accumulated by the end of the 8th unit. Seldom does it take over 10 and it may occur as early as the 4th unit. Most users of A-V report that operators produce twice as much with the aid of AV as compared with normal production methods.

Value of any production tool can be measured by the extent to which it contributes to the production of an acceptable item, on schedule and at a competitive price. While A-V's primary measure of value is the ability to affect savings, its true effectiveness must be weighed in each specific case before implementation.

Write No. 137 in Box on Inquiry Card



Ultra-Reliability

By William Belt, Associate Editor

Just how do you go about setting up a production line to produce an ultra-reliable electronic or electromechanical component or equipment? To what extent does it involve design? Quality control? Inspection? Parts procurement? Testing? Kind of production personnel, paper work, management that you need?

After several years of thought, trial and experimentation, Bourns, Inc., Riverside, Calif., in late 1959 standardized a program to achieve the highest possible reliability in a Trimpot lead screw actuated potentiometer. Since that time Bourns has shaken out the program to the extent that they feel it represents an ultimate in "achieved reliability".

Bourns' engineers started out with the simple fact that the highest possible level of reliability and performance can never be achieved unless the product itself is inherently reliable with respect to design. Thus, all of their models in production were carefully analyzed for maximum inherent design reliability. Periodically design evaluations were made; production records were studied; assembly yields and electrical yields were analyzed; two years of monthly environmental test data on production models were studied and evaluated. As a result their engineers selected their current model 224 as the foundation for their first ultra-reliable Trimpot.

Why should a model currently in production be chosen for upgrading rather than design a new high reliability unit? To design, test, produce and shake down a completely new model takes as much as two years. New parts tooling has to be acquired. New production tooling, methods and techniques have to be developed. All these areas involve a learning curve and an extended evaluation. Selecting a model already in production saves this period of time and makes a model with a high degree of inherent reliability – as demonstrated by two years of test data – immediately available to the company for an ultra-reliable program.

PRODUCTION CONTROLS

To assure complete and thorough print and change controls, Bourns issued a new series of piece part and assembly prints, process prints, operation sheets and station instructions. These documents were limited only to persons directly involved in their new program. All proposed changes in materials, design, process and manufacturing procedures had to be approved by quality control, engineering and manufacturing engineering before any documents could be changed.

To preclude the possibility of inadvertent usage of standard line parts or mix-up with completed standard potentiometers, Bourns set aside an isolated and enclosed production area. Since all of their models are assembled under clean room conditions, their ultra-reliable area became a clean room within a clean room. Only the most efficient and experienced production and inspection personnel were selected for this new line.

Production lot control was put into effect by limiting production quantities of the ultra-reliable potentiometer to small, easily workable lots. Each lot is numbered; this number is printed on the finished product. Each production order contains inspection number assigned to the lot quantities of the individual piece parts. This method permits Bourns' engineers to thoroughly trace all individual parts that go into a finished unit. Leftover parts from one lot are never used in another lot but are returned to standard production lines.

QUALITY CONTROL

Bourns uses a combination of sample and 100% inspection of all piece parts, used in the ultra-reliable program, to reduce the possibility of using a defective component. Sample inspection stations are located throughout the process and production operations to insure the highest standards of workmanship.

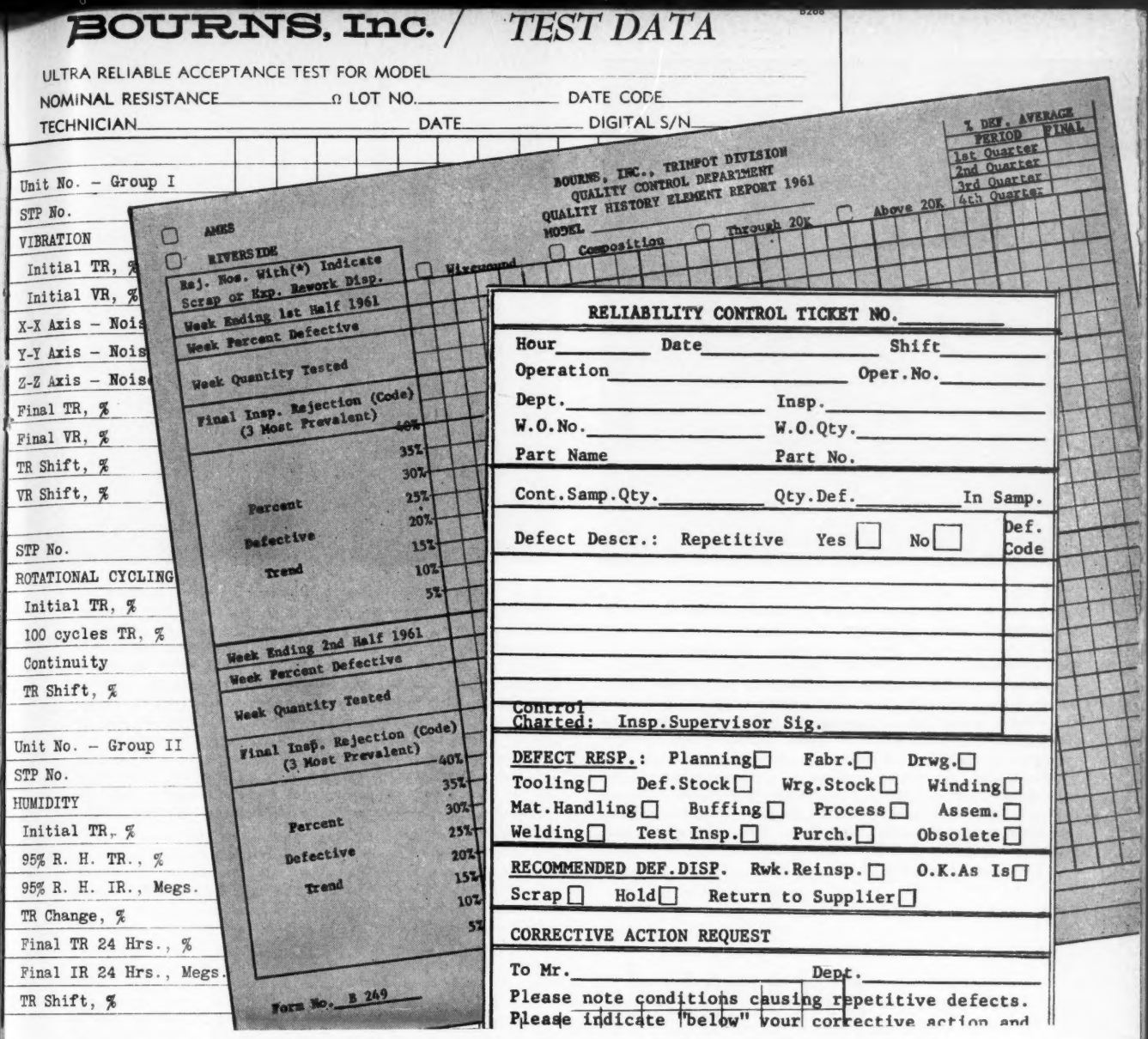
After receiving inspection, the parts are packaged in production lot quantities and identified with an inspection number. The inspection form with the corresponding number contains a complete history of the piece part such as vendor, date received, inspection information, material certifications. If, at any time, a part proves inferior after receiving inspection, it is completely traceable not only to the production lot but also to the stockroom and vendor. Bourns permits customers to examine inspection records at any time.

Predetermined in-process inspection points are established on the line and defined on Classification of Defect sheets. Any given production lot can be processed only through these points and can go no further without this in-process inspection. In the production cycle of the ultra-reliable Trimpot, there are several of these inspection stations.

Units are complete except for sealing when the first of three electrical inspection tests are run. The first inspection includes measurement of: Total resistance, End settings, Noise, and Insulation resistance. Following this first inspection, all units are subjected to series of screening tests designed to preclude the possibility of failure in later tests or in the ultimate application. These tests, listed in the sequence performed, are:

a) High temperature stability
b) Temperature cycling
c) Load life burn in

When the units have completed these



BOURNS, Inc. / TEST DATA

ULTRA RELIABLE ACCEPTANCE TEST FOR MODEL

NOMINAL RESISTANCE Ω LOT NO. DATE CODE

TECHNICIAN DATE DIGITAL S/N

Unit No. – Group I
STP No.
VIBRATION
Initial TR, %
Initial VR, %
X-X Axis – Nois
Y-Y Axis – Nois
Z-Z Axis – Nois
Final TR, %
Final VR, %
TR Shift, %
VR Shift, %
STP No.
ROTATIONAL CYCLING
Initial TR, %
100 cycles TR, %
Continuity
TR Shift, %
Unit No. – Group II
STP No.
HUMIDITY
Initial TR, %
95% R. H. TR., %
95% R. H. IR., Megs.
TR Change, %
Final TR 24 Hrs., %
Final IR 24 Hrs., Megs.
TR Shift, %

AMRS
RIVERSIDE
Wirewound

Rej. Nos. With(*) Indicate Scrap or Exp. Rework Disp.
Week Ending 1st Half 1961
Week Percent Defective
Week Quantity Tested
Final Insp. Rejection (Code) (3 Most Prevalent)
Percent Defective Trend
40% 35% 30% 25% 20% 15% 10% 5%
Week Ending 2nd Half 1961
Week Percent Defective
Week Quantity Tested
Final Insp. Rejection (Code) (3 Most Prevalent)
Percent Defective Trend
40% 35% 30% 25% 20% 15% 10% 5%
Form No. B 249

BOURNS, INC., TRIMPOT DIVISION
QUALITY CONTROL DEPARTMENT
QUALITY HISTORY ELEMENT REPORT 1961
MODEL
Composition Through 20K Above 20K

% DEF. AVERAGE
PERIOD FINAL
1st Quarter
2nd Quarter
3rd Quarter
4th Quarter

RELIABILITY CONTROL TICKET NO.
Hour Date Shift
Operation Oper.No.
Dept. Insp.
W.O.No. W.O.Qty.
Part Name Part No.
Cont.Samp.Qty. Qty.Def. In Samp.
Defect Descr.: Repetitive Yes ☐ No ☐ Def. Code
Control Charted: Insp.Supervisor Sig.
DEFECT RESP.: Planning☐ Fabr.☐ Drwg.☐
Tooling☐ Def.Stock☐ Wrg.Stock☐ Winding☐
Mat.Handling☐ Buffing☐ Process☐ Assem.☐
Welding☐ Test Insp.☐ Purch.☐ Obsolete☐
RECOMMENDED DEF.DISP. Rwk.Reinsp.☐ O.K.As Is☐
Scrap☐ Hold☐ Return to Supplier☐
CORRECTIVE ACTION REQUEST
To Mr. Dept.
Please note conditions causing repetitive defects.
Please indicate "below" your corrective action and

Here are a few of the many forms Bourns uses for control. Top form is a detailed reject tag that goes to various people for corrective action. Tags can be attached to rejected lots as well as to specific units within rejected lot.

tests, they are again electrically inspected.

TESTING PROGRAM FOR VERIFICATION

The previous techniques essentially describe the philosophy and techniques behind Bourns' program. However, the "achieved reliability" must now be measured. To measure the extent to which Bourns has achieved their goal of 100% reliability, they have devised an extensive test program. Nine hundred completed units have been started on a 10,000 hour load life test. These units, mounted on printed circuit boards, have full power applied per MIL-R-19A. Throughout the duration of this test, as well as at its completion, achieved reliability data is available.

After a given lot of units is sealed and has successfully completed the third and final electrical inspection, a statistical acceptance test sample is withdrawn and the balance of the lot impounded. An impounded lot is only released by Bourns after vibration, humidity and rotation cycling tests that make up an acceptance test are completed without failure. Test samples, of course, are not released to stock; they are either discarded or used in extended testing. Acceptance test data for the lot involved accompanies each shipment of the ultra-reliable potentiometers. In addition to long term full power tests, Bourns also established wear-out curves for environments such as various power levels, high temperature exposure, temperature cycling and humidity. Of prime interest in these tests are the total resistance and/or wiper position stability under prolonged periods of operation. Data from these tests is summarized periodically.

The foregoing is essentially Bourns' best method program to achieve the highest possible level of reliability for their Trimpot potentiometer. After revealing reliability requirements for such projects as Polaris, Minuteman, Titan and Lockheed Space, their engineers set an initial reliability goal as 0.01% per thousand hours, but they are already working on a program to improve this goal to 0.001% per thousand hours.

Fig 1 Automatic Relay Tester is one of GE's QIT Systems for testing and evaluation of a component and the process which produces it. It automatically programs the tests to be performed and the parameters to be measured. Data is normalized and presented in the form of standardized cellular data which is easy to interpret for corrective action. This data may be analyzed by an X Sigma (Trend) Computer (optional) and can be used effectively for in-process testing. At the present rate of savings, GE believes the relay tester should pay for itself in about 1½ years. The equipment measures and classifies the following parameters: coil resistance; contact resistance; pickup volts or amps; dropout volts or amps; pickup bounce time; dropout bounce time; pickup operate time (including bounce time); dropout operating time (including bounce time). Over-all system signal accuracy — better than 0.5%. Some tests are accurate to better than 0.2%. Price: about $24,600.

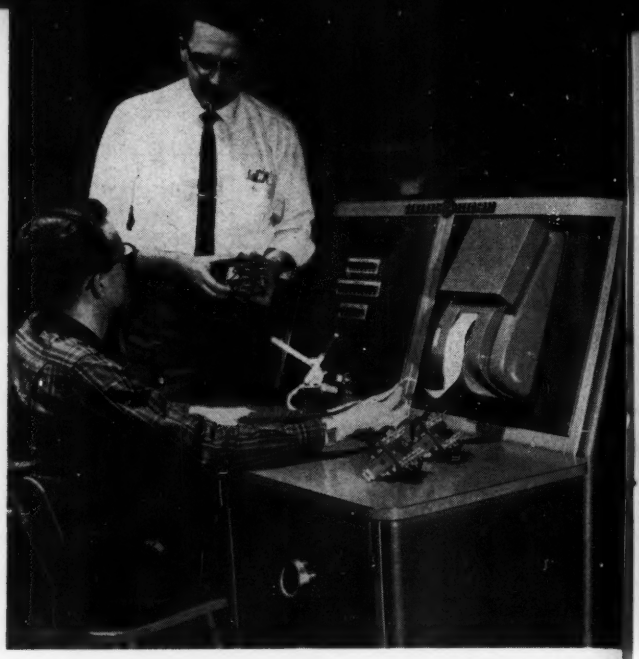


Fig 2 Autotran III (Automatic Transformer Tester) performs six transformer test operations according to a punched tape program. Test requirements for a given transformer model are entered in code form by the tape reader, and each programmed test and its results are visually presented on the operator's panel as well as printed out by a paper tape printer. Unit performs the following transformer tests: included voltage; hi-pot; exciting current, voltage ratio and polarity ratio; core loss test. According to GE, the system offers: increased speed of testing; quality information suitable for statistical analyses resulting in rapid quality control; reduced systematic errors such as parallax error by observer; reduction of random errors such as deviation of observer's quality judgment; elimination of incorrect instrument readings by observer. Price: $20,000 to $30,000.

Automated Quality Control

Ten Programmed Testing Systems Automatically Test Components and Circuits, Classify Data and Detect and Control Production Trends

Do quality control procedures cost more than they add to final product value? According to James L. Miller, Mgr. of Machinery Automation Control Sales of General Electric's Specialty Control Dept., conventional quality control practices frequently increase cost disproportionately to the improvement in quality. However, based on experience, Miller believes that systematic programs to automate quality control actually can reduce total costs and that GE's "Quality Information and Test Systems" concept makes this approach to 'total quality control' practical by meeting the following objectives:

- They prevent — rather than merely reject — failures in the product or process. By providing timely test data in a form readily usable for analysis and control of the process and quickly enough to outpace the dynamics of a changing process, they allow the user to detect trends towards failure and correct them before scrap is generated.
- They provide a continuous, automatic program to gather, summarize and present data, make appropriate decisions, and initiate proper corrective action.
- They are designed around pre-tested, modular-constructed elements which minimize shipping, installation, and maintenance costs of the equipment and which provide a high degree of flexibility to meet changes in product and process test requirements.

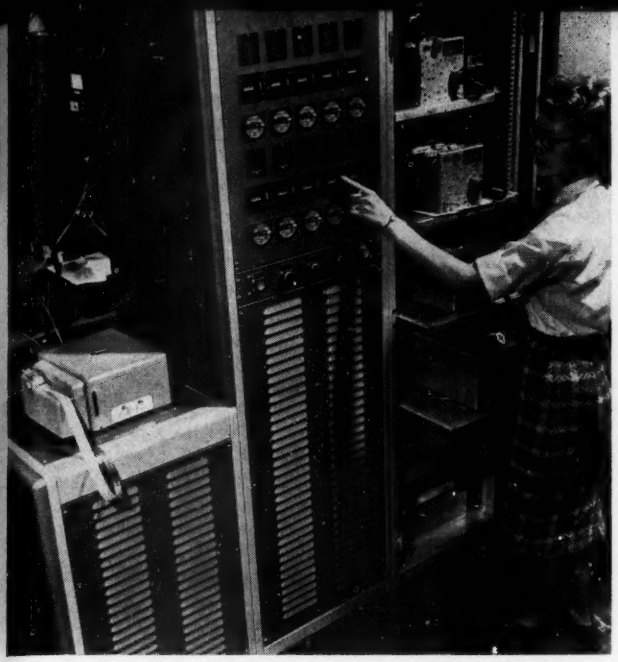


Fig 3 GE's Multicycle System, a programmed reliability tester, enables manufacturers to test a wide variety of electrical components and sub-assemblies and to establish criteria for product improvement and for proper test procedures. In an actual case of operation, Multicycle performed simultaneous testing of 10 identical units in 2½ minutes (manual methods required from 30 to 45 minutes to test an individual unit). A "mean time to failure" curve is derived by testing a representative production unit on the automatic console, using environmental equipment to simulate operating conditions. Results are used to prepare a tape for programming regular production units. This analysis and test procedure leads to an economic balance between specification life requirements, field failures and product service expenditures, GE reports. A standard 8-channel punched tape controls sequence, number of tests, test time, programs temperature in the environmental enclosure and limits for each check. Test run is functional, not quantitative. When malfunctions occur, failure indicators identify failed circuit in literal form. Simultaneously all power inputs are removed from defective product, while tests on remainder of units continue. Test parameters may include normal operating conditions, under- and over-frequency, under- and over-voltage, differential protection, unbalanced current, automatic paralleling, reactive bias, neutral current, auxiliary relaying and others depending upon application. Price: about $21,000.

Fig 4 Wire checking, which used to take weeks when performed manually, now can be done in a few hours with GE's Programmed Automatic Circuit Tester (PACT) which can scan up to 3600 points in a wire harness or assembly. PACT not only assures that proper points are interconnected, but that there are no missing or extra wires. The system is programmed from a punched tape prepared from a wiring table; includes proper sequencing of points, all engineered circuit connections, circuit numbers. PACT scans at the rate of 540 points per second; checks for continuity; indicates error by stopping test, showing circuit point number, tape block number, "extra wire," "missing wire." Scan time for the condition of no programmed, missing or extra wires 6.7 seconds. Single programmed wire: 10 seconds. It handles assemblies, racks, or modules for subassembly and assembly operations in a manufacturing process. For units under test with less than 3600 points, it can be set to eliminate scan for unused points. Price: about $20,000, depending upon capability and special features.

• They can be designed, installed, and operated at costs which are justified completely by optimum savings in manpower and time, maximum versatility, and elimination of scrap, rework, and customer complaints.

General Electric, so far, has designed 10 equipment systems; several different types are presently at work in GE plants, others are under construction and test at the Specialty Control Dept. at Waynesboro, Va. In general, the General Electric systems perform automatic programming of test sequences and limits and give cellular presentation of test results analyzed by a trend computer.

QIT systems result in faster testing and fewer test stations necessary, and, by eliminating the vagaries of human judgment from the measurement and analytical process, they assure better accuracy and consistency of tests, Miller pointed out. "Just as we have been closing the loop in the basic and continuous-flow process industries such as steel and cement with electronic feedback, now we can begin to close loops statistically in industries manufacturing discrete parts and assemblies, such as electronic components, panels and consumer appliances," he said. QIT systems close the control loop in the following manner: Test fixtures and sensors measure significant product parameters; an automatic program, such as on punched tape, orders the sequence of tests; and input stimuli and loads are generated and fed into the system as test reference values that may be constant or programmed at varied limits to fit the particular product form being tested. An input-output distribution function decodes the program and ties the proper parts of the system together. A measurement function takes quantitative readings of each significant variable tested, comparing them against test reference values from the input stimuli. An evaluation and decision function interprets the measurement, normalizes the data and provides signals to automatically adjust or sort the product and automatically or manually close the control loop on the process. A data presentation and recording function provides a printout record of product performance and a feedback system provides information flow between appropriate functions and actuates mechanical devices for handling, classifying, and adjusting the product.

Special equipment for two key functions of the system has been developed by GE. The Data Classifier, performing the evaluation and decision function, is universally applicable to all QIT systems. Because its input is normalized data, it makes its decisions without needing to know the

Fig 5 Four pole relay in-line tester for use in an assembly line where calibrating may be necessary before a final canning operation. Programming is done by functional push-buttons which set up all test and metering conditions. Contact resistance measurements are made automatically with a "go-no go" readout. Features of the tester, according to GE are: it tests both voltage and current sensitive relays; ten different tests performed from a single plug-in operation; relay fixture can be rotated in the horizontal plane allowing the operator to observe the physical operation of the relay contacts; functional lights show the operation (or failure) of each contact at the proper voltage (or current) level; contact resistance is measured automatically with functional lights showing acceptance or failure; in actual use, test time was reduced by 50%; although this tester is primarily designed for four-pole relays, it can be modified to test other relays. Price: $4,000 - $8,000.

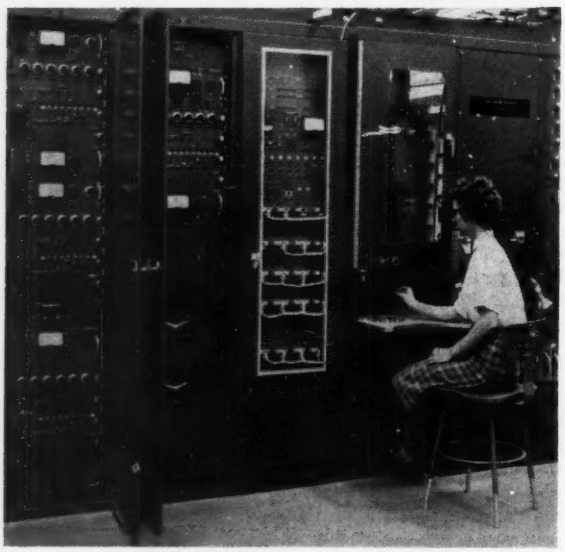


Fig 6 As a final component test system, GE's Automatic Transistor Classifier physically classifies the product in one of 18 bins. Because of the long leads on transistors, an operator must plug the transistor in, but from that point on, the operation is automatic. Price: $35,000 - $60,000.

nature of the product or parameter being tested. It presents data in cellular form, the universal language of quality control computation. Results of each parameter test are read out by the Data Classifier on a scale of 30 cells, which may be used to determine its value in relation to "accept-reject" limits, and also for direct use in plotting frequency diagrams.

For analysis of quality trends, GE has developed a simplified computer called the X-Bar Sigma (Trend) Computer. Combined with a Data Classifier it becomes the part of the QIT system which provides the average (X) and the standard (σ) of a parameter for a sample of units under test. By performing these computations on successive samples of production, the X-Bar Sigma Trend Computer can quickly and accurately predict a trend or change in a manufacturing process. This is extremely important to the quality control engineer in two ways, Miller pointed out. First, it gives warning of progressive error which may put the process out of control and second, it helps him discover more quickly the significant variables in any new process and when these are known the output of the Trend Computer may be used to control these process variables automatically. This completely closes the control loop and creates a truly automated process to the extent that the particular process is capable of being self-optimizing, Miller said. However, he emphasized that closing the process loop represents the ultimate capability of the Quality Information and Test System and need not be realized in order to make such a system pay for itself.

Presently available testing systems include an automatic relay tester shown in Fig 1, three models of a transformer tester (Autotran) (Fig 2), Multicycle reliability tester (Fig 3), Programmed Automatic Circuit Tester (PACT) (Fig 4), Four-Pole Relay In-Line Tester (Fig 5), Automatic Transistor Classifier (Fig 6), Automatic Diode Grader (Fig 7), Basic Appraisal System for Incoming Components (BASIC), "Spark and Mark" Cable Test, and a Dynamic Circuit Analyzer.

A versatile Basic Appraisal system for incoming components has the following fundamental measurement capabilities: ac and dc voltages and currents; time; impedance; Hi-pot, ratio, exciting current, core loss; rated load; and phase shift. Flexibility of the system and programmable input eliminate the multiplicity of separate test stands usually found in the incoming test area, reduces the number of people involved, improves measurement accuracy and reliability, provides the speed to allow testing of a larger percentage of incoming components, and can save space required for testing, according to company reports. Universal modular design allows for versatility in handling a wide variety of parameters and components. All measurements are automatically compared to acceptance limits and a decision rendered. Readout can be programmed to a printer, card punch, or tape punch. The price of this system runs from $20,000 to $100,000.

Dynamic Circuit Analyzer represents a new approach and the most difficult one for automatic test equipment. Even though some of today's printed circuit boards have more than 100 components in complex circuitry, the tendency has been to make static tests by probing the connections on the surface of the board. Because of the multiple series and parallel paths, expected results for each of many probings must be calculated carefully in advance for each kind of board. In addition, according to GE, the test fixture is complicated and relatively unreliable. However, testing dynamically at the plug terminals reduces fixturing to a simple plug. Why isn't this method commonly used? GE believes the answer lies in the difficulty in accurately measuring and interpreting dynamic functions. Their Dynamic Circuit Analyzer overcomes this

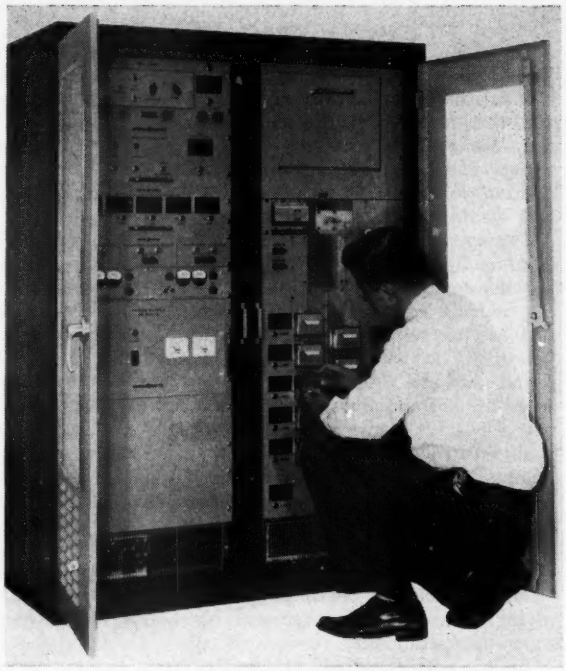


Fig 7 Another unit of GE's "Quality Information and Test Systems" is an Automatic Diode Grader that senses polarity and then performs a dynamic electrical test on the diodes automatically. It classifies the diodes and either accepts or rejects them. Those that pass the dynamic test are sorted into one of 10 "accept" bins; those that fail are ejected into an eleventh "reject" bin. Minimum rate of operation is 30 per minute. Information suitable for statistical analyses results in rapid quality control. Price: $15,000 - $27,000.

difficulty and is expected to offer tremendous time savings in the preparation of test programs, more reliability in the test equipment and test results. The basic principle and specific system are also applicable to circuit testing other than printed circuit boards. Price ranges from $20,000 to $50,000 depending on requirements.

Miller reported that several QIT systems in use in GE plants are saving enough from reduced appraisal costs and reduced internal failure costs alone to pay for themselves in six months to two years of use. "As an example of how QIT systems save money, he explained, "we have had Multicycle in operation for a year at Waynesboro and have proved cost savings of $21,700 in quality appraisal and failures which did not escape detection. Multicycle has made it feasible to perform reliability use-testing of aircraft electrical sub-assemblies which our customers could not afford to have us perform by other means. We have saved the entire list price of the Multicycle system — $21,000 — and have prevented customer dissatisfaction of incalculable value as well. Savings of the Programmed Automatic Circuit Tester (PACT) are even more startling — $20,000 in appraisal costs alone plus half again that much in failures detected and corrected. Comparable results are indicated for other QIT systems. The precise amount of saving will, of course, vary with the requirements and efficiency of each user's quality control system, but we feel these figures are representative."

General Electric can provide engineering assistance in defining potential customer testing needs and with preengineered equipment modules, Miller said, his department is ready to provide QIT systems for a variety of testing situations.

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CIRCLE NO. 15 ON INQUIRY CARD

Production Line Soldering

System of Matched Modules Increases Output and Reliability of Printed Circuit Boards and In-Line Terminals

In addition to producing their own proprietary equipment, Bay State Electronics Corp., Boston, Mass., subcontracts for many large electronic firms. In this role, they are constantly faced with the task of satisfying a variety of quality requirements. One of their chief production problems was to find a versatile soldering method that would meet a multitude of standards.

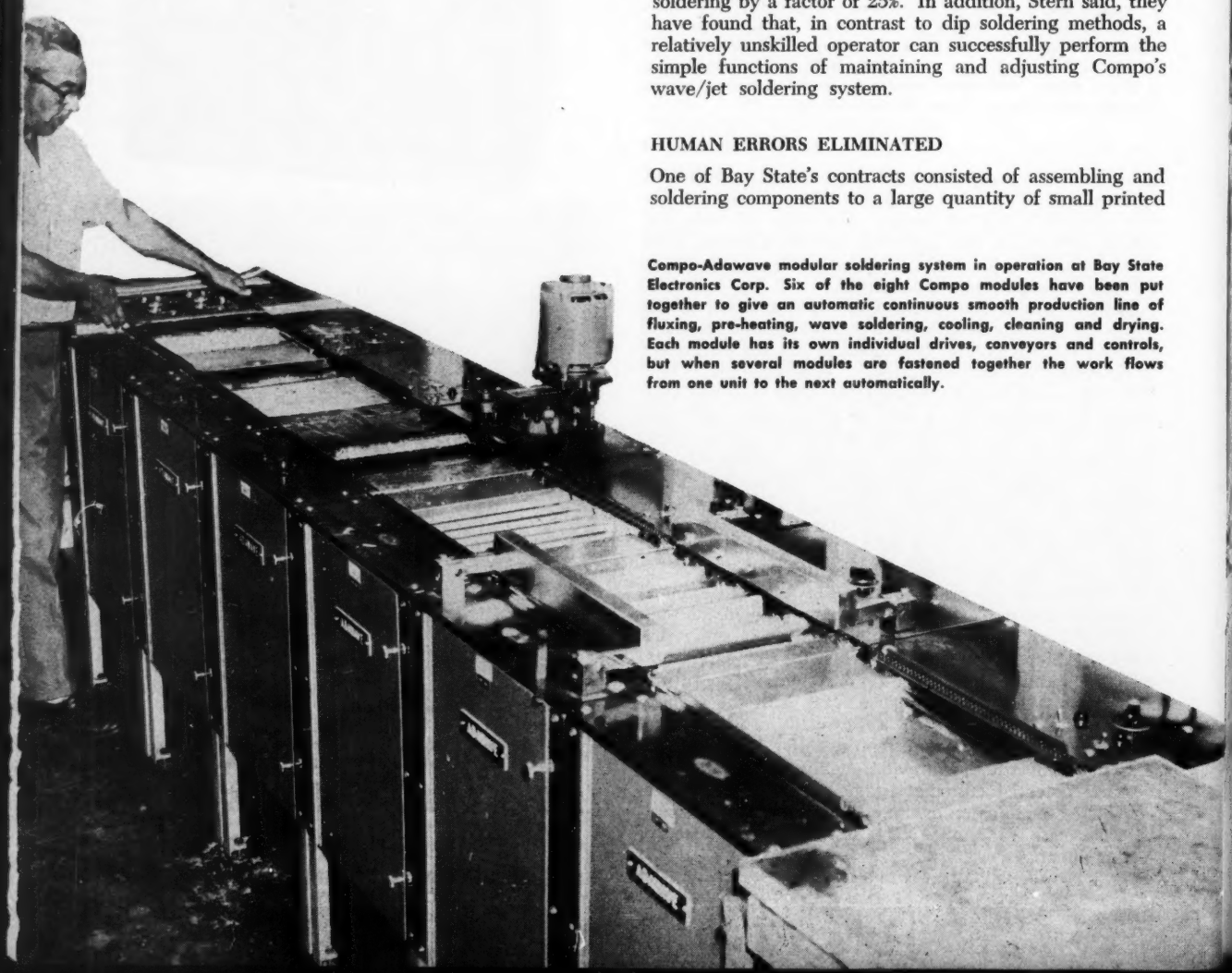
During the past few years, the company progressed from hand soldering techniques to a method of dip soldering of printed circuit board assemblies. However, according to Irwin Stern, Asst. Dir. of Mfg., the disadvantages of these two soldering methods prompted the company to investigate available automatic soldering systems. They found that the "Adawave" Soldering System, manufactured by Compo Shoe Machinery Corp., Special Products Div., Waltham, Mass., provided the necessary versatility to meet the majority of their soldering requirements.

During the four months that the Adawave system has been in operation, its effect on production costs and product reliability has been substantial, Stern reports. Adawave has reduced costs in the following areas: actual soldering operation itself; preparation for soldering (applying flux, etc.); flux removal operations; and solder touch-up operations.

In line with these reductions, Bay State has increased their production output appreciably. Stern fully expects to reduce the overall cost of component assembly and soldering by a factor of 25%. In addition, Stern said, they have found that, in contrast to dip soldering methods, a relatively unskilled operator can successfully perform the simple functions of maintaining and adjusting Compo's wave/jet soldering system.

HUMAN ERRORS ELIMINATED

One of Bay State's contracts consisted of assembling and soldering components to a large quantity of small printed

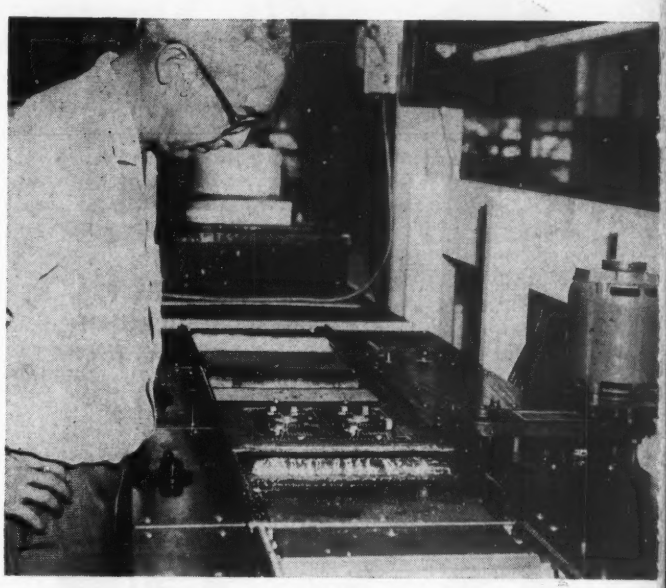


Compo-Adawave modular soldering system in operation at Bay State Electronics Corp. Six of the eight Compo modules have been put together to give an automatic continuous smooth production line of fluxing, pre-heating, wave soldering, cooling, cleaning and drying. Each module has its own individual drives, conveyors and controls, but when several modules are fastened together the work flows from one unit to the next automatically.

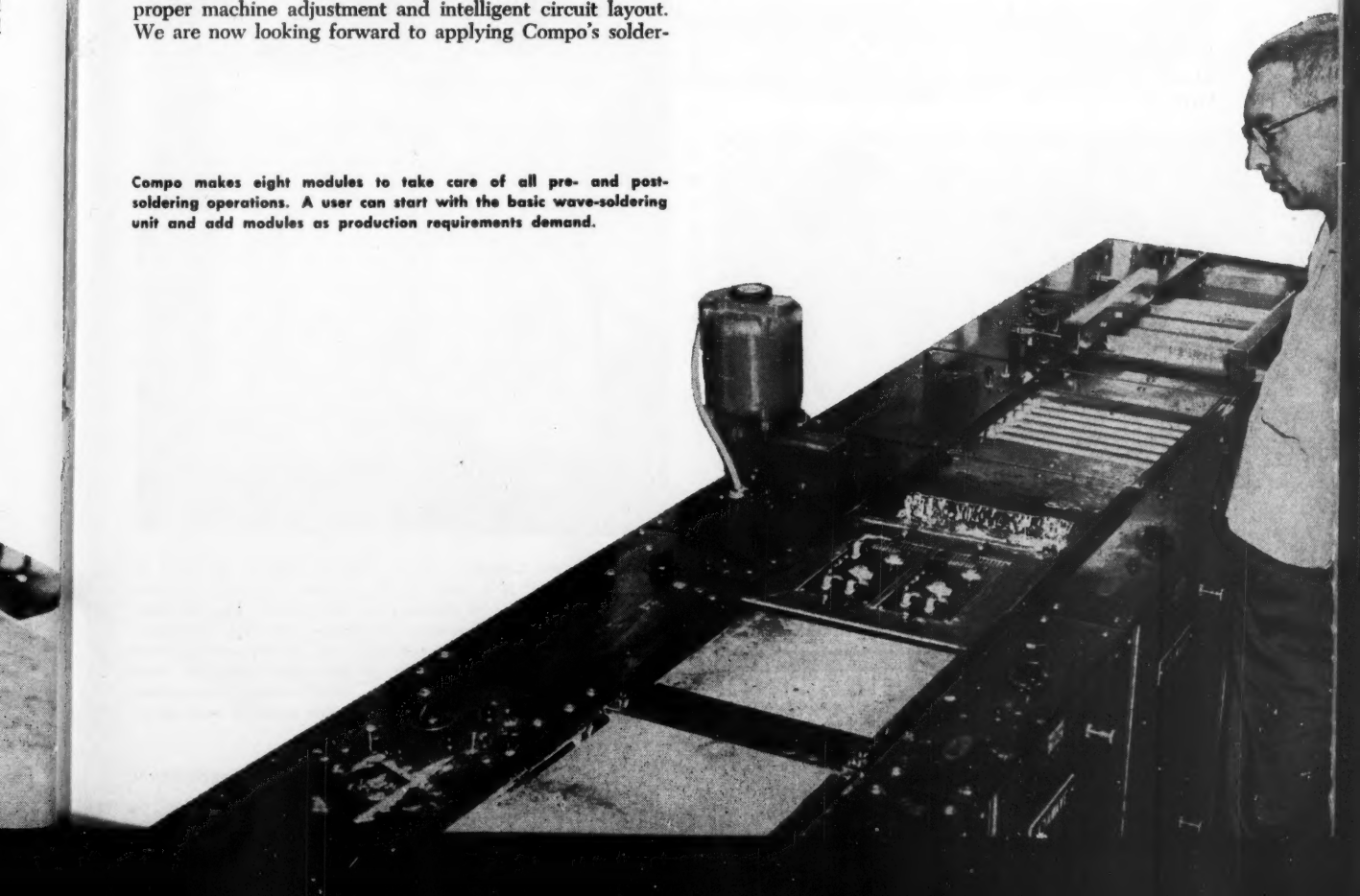
circuit module boards which then had to be soldered to "mother" boards, along with additional components. Use of dip soldering techniques, Stern explained, would have required a fairly extensive program involving holding fixtures for the small modules. In addition, Bay State's previous experience indicated that there is a considerable amount of operator fatigue when dip soldering work of this size, with an accompanying quality degradation. By using the Adawave system they were able to solder nine modules in one pass, on a consistent and uniform basis. Since Adawave's soldering rate is approximately nine modules per minute, this job resulted in a rate of roughly 250 solder connections per minute. Thus, in this one case, Bay State Electronics was able to effect a 28% measured reduction in overall assembly and soldering labor plus a significant quality improvement.

In Bay State's quality control and inspection operations, the Adawave soldering system has reduced solder defects, board warpage, and thermal failures of components. An increase in inspection and test output has also been realized.

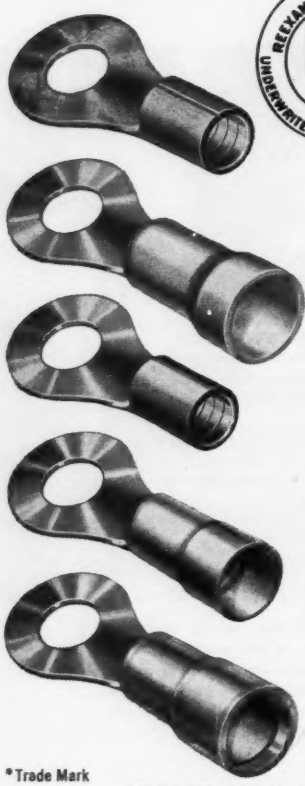
Analyzing the results of 4 months operations with the Adawave system, Stern summarized as follows: "The fact that Compo's soldering system automatically applies flux, pre-heats, solders, cools, cleans and dries the panels, removes many potential sources of human error. We find that the system gives a high quality, fine appearing soldered surface which is extremely consistent from board to board. Microscopic inspection of soldered panels reveals complete and uniform coverage of all desired circuit areas with excellent flow thru when eyelets or plated thru holes are used. Since the components, when properly mounted, undergo no movement during the soldering, cold solder joints are effectively eliminated. Other major soldering defects such as excess and insufficient solder and bridging between adjacent circuits can be minimized thru proper machine adjustment and intelligent circuit layout. We are now looking forward to applying Compo's solder-



Circuit board approaches the molten solder, pulsating hollow wave. Compo-Adawave's solder module receives pre-cleaned, pre-fluxed panels and carries them across the wave whose motion opposes that of the board. Solder temperature, wave height, and conveyor speed are precisely controllable for optimum results.



Compo makes eight modules to take care of all pre- and post-soldering operations. A user can start with the basic wave-soldering unit and add modules as production requirements demand.



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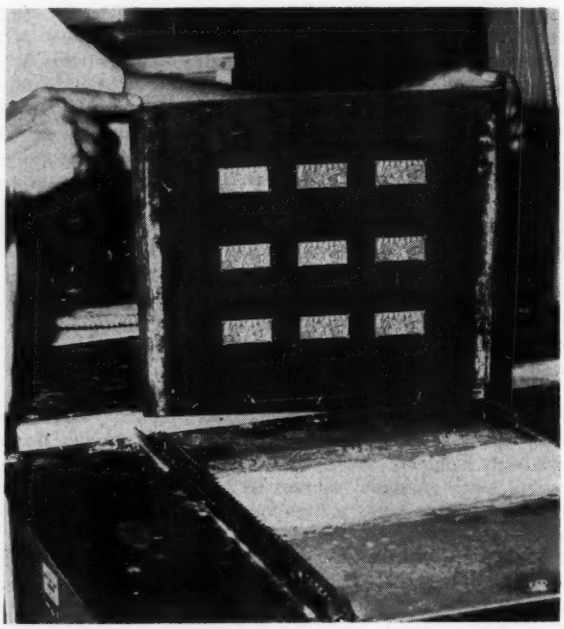
ing system principle to non-printed circuit terminal board assemblies. Our initial investigation into this area has satisfied us that their equipment can be quickly and easily converted into a jet soldering system which will provide the same efficient results on terminal lug panels as on our printed circuit panels."



In the Compo-Adawave soldering system, the work is "nested" in a simple holding frame. The nests are generally made of Masonite or wood which can be made by the user or supplied by Compo. Different patterns or circuit sizes and configurations may be intermixed without setup changes. Because of Adawave's relatively short hot-solder exposure time, an easily applied, inexpensive masking tape can be used to cover voids or openings in circuit panels.

ADD MODULES AS NEEDED

Compo-Adawave automatic soldering system consists of eight unit modules — spacer, fluxer, pre-heater, solder, cooling, cleaner, warm air dryer and volumetric air dryer. Performing all the functions associated with soldering, the modules can function independently with their own individual drives, conveyors and controls, but they are designed as companion units that can be fastened together to give one continuous production line system. A user can start with the soldering module only, then add units as requirements demand.

Series 307 modules handle printed circuit boards as wide as 7 to 8 inches depending on the panel's circuit configurations, while Series 311 units accept boards up to 11 to 12 inches in width. There are no limitations on length. All modules are 35″ high, 20″ wide and 30″ deep with conveyor speeds adjustable to 4 feet per minute.

WAVE AND JET SOLDERING

In Compo-Adawave's soldering module, the molten solder is pumped upward through an orifice which forms the flowing metal into a hollow pulsating wave whose motion opposes that of the circuit board. Unit's controls optimize solder flow volume, temperature and contact time so that every pre-fluxed surface is soldered cleanly without "bridging", "tailing" or "icicling."

An adapter converts Compo-Adawave's basic wave solder flow to a jet solder. Pre-positioned jets emit solder upward and against downward-pointed pre-fluxed in-line terminals or component leads. Soldering action is the same as in wave-soldering operation. Converters may be arranged for simultaneous partial wave and jet soldering.

In addition to the soldering unit, Compo's modular system consists of:

- Foam Fluxing Module: — air-operated liquid foam fluxer, with its own conveyor and controls for current flow, produces small flux bubbles that penetrate every required area with no unwanted coverage.
- Preheater Module: — unit has an infra-red radiant surface that raises panel temperature to dry out flux solvents. This module, which prevents thermal shock, spatter, balling or gassing in holes, is especially important when working with such items as plated thru boards or heat sensitive base material.
- Cleaning Module: — when positioned ahead of the fluxing module, this cleaning unit, with counter-rotating brushes removes oxides from the undersurfaces of panels, hardware and component leads. When used after soldering, the module removes flux residues. Two pairs of brushes and three tanks for cleaning and rinsing are provided.
- Two Air-Drying Modules: — a warm air-drying unit circulates heated air to remove moisture from panels. A volumetric air-drying module is a more advanced and a complete drying unit.
- Cooling Module: — cool air, blowing through tubes, protects parts that are subject to heat degradation. This cooling unit gently returns panels to ambient temperature.
- Spacer Module: — a conveyor provides space for in-line assembly, inspection or other functions in conjunction with the over-all soldering processes.

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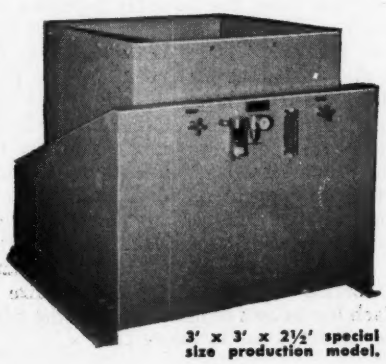
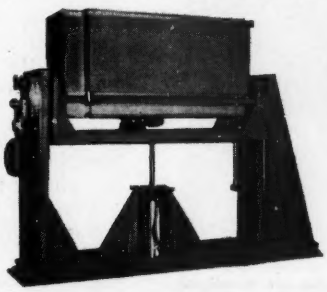


3′ x 3′ x 2½′ special size production model.



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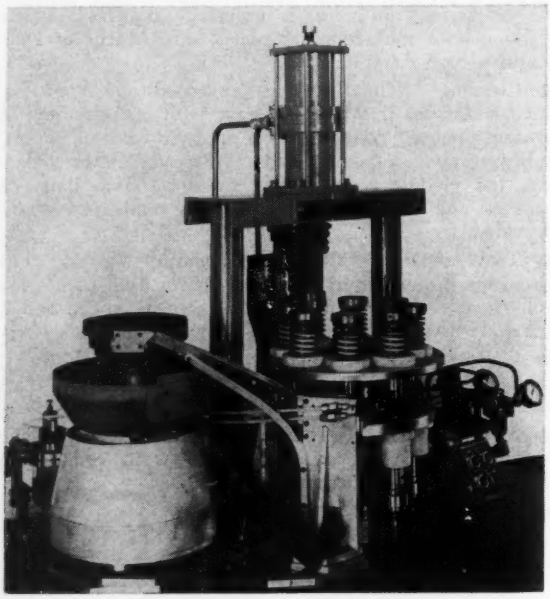
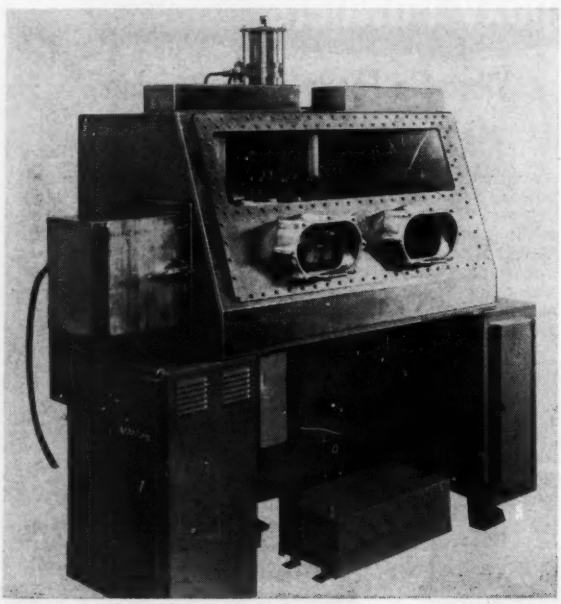
Automated Transistor Welding



Welding system before enclosed in a nitrogen atmosphere.



Welding equipment, feed mechanisms, and dial table are enveloped in a nitrogen atmosphere. Operator uses openings in cabinet to load transistor headers, then starts the machine sequence with foot-operated switch. System operates continuously until operator depresses switch to stop it.

NEW EQUIPMENT

At speeds ranging from 17 to 23 per minute, an integrated and sequenced transistor welding system loads and welds TO-5 or TO-18 transistor components and then automatically unloads the assembly. Resistance welding system consists of a 30 KVA two-column welding machine, an eight-station indexing table and two stacked vibratory feeding mechanisms. Due to the double-deck design in the dial table, alignment of the work with the electrodes is no longer dependent upon the accuracy of the table's rotation. All steps except loading transistor headers are performed automatically and all are done in a controlled atmosphere chamber.

Bench-mounted welding machine, Model 700 made by Thomson Electric Welder Co., produces high quality projection welds between a transistor can and a header. The machine, along with the table and controls, is mounted on a fabricated steel cabinet 36 inches in depth, 48 inches in width and 26 inches in height.

Welding head, supported between two 2½-inch diameter pipe columns on an overhead channel, operates in a vertical plane to engage a pad on each of eight upper electrodes. Diameters of the engaging parts are 2¼ inches on the head and 2⅜ inches on the electrode. Parallelism between the surfaces is held to a tolerance of ±0.0005.

INDEXING TABLE

Eight-station, one-piece Geneva table contains the upper electrodes, each mounted through a nylon sleeve and equipped with bronze, non-magnetic springs for return; the lower electrodes, also guided in nylon sleeves; nylon rollers; a barrel cam that bolts around the base of the table; a speed reducer; electric motor and drive train.

As each lower electrode approaches its apogee, its nylon roller bears on a spring-backed segment provided at the rear of the barrel cam. Concurrently the electrode is imposed over a grooved contact pad. At this point the welding cycle starts. Welding head descends, engages and depresses the upper electrode against the lower; the work is now welded. The spring-backed segment absorbs the pressure exerted on the roller and, when freed of the force, returns the roller to its original path of travel.

Leaving the welding zone, the assembly overrides another cam mounted on the base of the table. This cam engages the lower end of a ¼-inch diameter nylon pin running through the lower electrode and raises it to push against the welded assembly lifting it out of the die. Permanent magnet on the top end of the pin holds the assembly until a nitrogen powered ejector, cycled by the air cylinder in the welding head, removes it onto a chute.

Vibratory feeder with two stacked bowls and two tracks automatically supplies transistor cans to the lower electrode dies. Operator manually loads the stems in the upper electrode. Actuation of a selector switch determines which bowl is vibrated and thus the particular size of can to be fed. Each has its own terminal point on the table.

Write No. 289 in Box on Inquiry Card

On-Line Ultrasonic Cleaning

Production line cleaning that is 30% more efficient than conventional cleaning techniques, such as vapor degreasing and spray washing, has been reported by Autosonics, Inc., Phila., Pa. The automated system consists of a series of machines that processes metal parts and electronic components, on a continuous, self-contained flow basis. Westinghouse Electric's ultrasonic generators and transducers that can be used with any conventional cleansing solution are part of its system. One model, the Multiwheel Autosonex 30-6, moves parts automatically through a series of rotating wheels during which time the parts are detergent washed, then ultrasonically scrubbed, rinsed, dried and finally discharged at room temperatures thoroughly clean. Entire operation, which can process as many as 18,000 parts per hour, can be integrated into any normal production line, according to the company.

In another of the machines – Model V-72 – tote-boxes filled with a variety of parts or assemblies enter on a cleated conveyer belt which is indexed into position on one of several platforms. The platform is elevated until its tote-box can be locked into position up against its corresponding overhead cover, an integral part of the spoked wheel. The platform then rotates on its own axis while the entire spoked wheel revolves in clock-wise direction, achieving a gimbaling action. During this rotation, the platform descends first into a vapor degreasing zone, then into the ultrasonic cleaning stage.

Built into the base of the 270-gallon steel tank is a Westinghouse Magnapak, spaced-laminate transducer which consists of individually attached laminations working in unison to provide the piston-like vibrations of the plate. In turn, these vibrations are translated into sound waves which are fed into the cleaning solution.

Available are Autosonex machines that are portable, require no piping, no special ventilation. Control system results in low solvent consumption, a major cost saving in ultrasonic cleaning.

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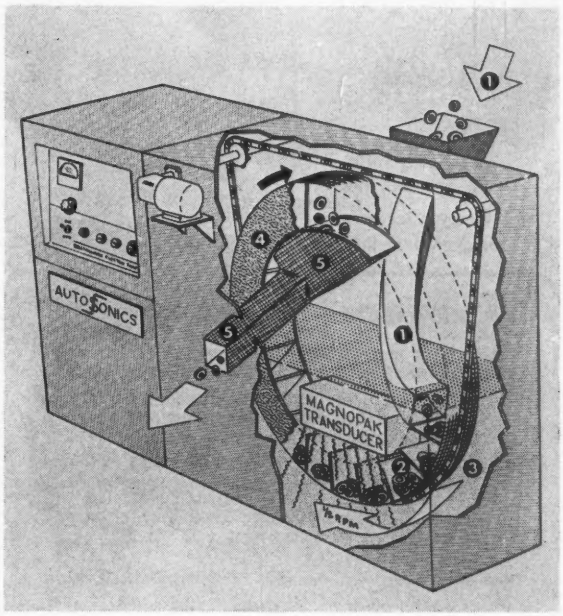

In the Monowheel Autosonex machine, developed by Autosonics, Inc., small parts can be deposited down a chuted conveyor (1), to a single-wheel transport (2) equipped with metal shelves. The wheel moving at a speed of 0.5 rpm carries the shelved parts into the Westinghouse ultrasonic cleaning tank (3) containing a liquid cleaning agent. Ultra high frequency sound waves generated by the transducer (positioned over the cleaning tank) act on the cleaning agent to produce a scrubbing action on the surface of parts. Wheel then carries parts through draining and drying phase (4). Seconds later, parts emerge from the exit slot (5) clean as a whistle. Designed as a modular unit, Monowheel can be ganged to provide rinsing, drying, acid and water solution action.

Visual Test and Soldering Panel

For a simple, fast and positive method of location in assembling or soldering groups of wires into various types of plugs, Winslow Product Engineering Corp., Arcadia, California, has come up with a unique panel that consolidates several operations into one. Operation of panel is extremely simple with no operator training necessary. For wiring a given plug, operator selects a plug adaptor and chart which matches the plug. Charts can be furnished to correspond with plug in either letter or number configuration. Adaptor and chart are inserted into position on the panel. Operator then connects the plug to be wired to the plug adaptor and begins to wire. When the soldering iron or probe touches a plug pin the corresponding number, or letter, lights up on the chart. This indicates that the proper pin is being wired.

Winslow reports that the panel has further application as a fixture for plug inspection or for many other circuit inspections. Also, since the chance of error is eliminated, use of the panel when assembling plugs makes final inspection of wired plugs unnecessary. It is also claimed that faulty plugs are immediately detected, thereby saving time in needless wiring and inspection of the plug.

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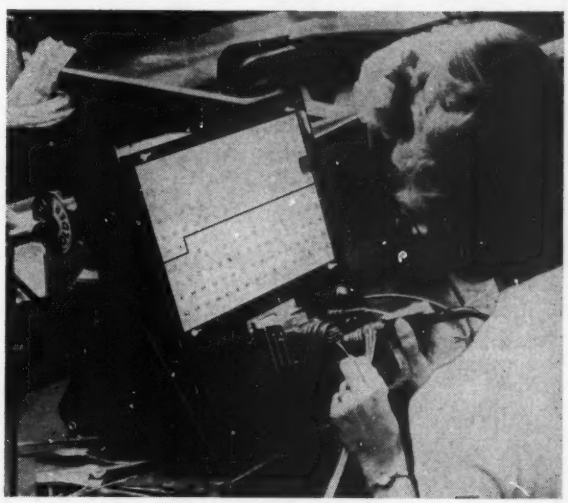

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Manufacturing Methods

NEW MATERIALS

Pressure Sensitive Tape

Pressure sensitive polyvinyl fluoride tape, Tedlar — DuPont's new polyvinyl fluoride film — is now available with a pressure sensitive silicone polymer adhesive on one side and can be purchased in roll form. Called Temp-R-Tape PVF, the tape offers exceptional weatherability, toughness, and chemical resistance in addition to good electrical properties. This combination of Tedlar and silicone adhesive suggests many uses in electrical fields, as well as wide application throughout industry as a protective covering, release surface and electrical insulation. Initially, samples will be available for evaluation in 1" by 5 yd. rolls at $5.00/roll. The Conn. Hard Rubber Co., New Haven, Conn.

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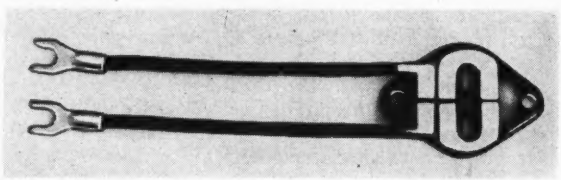

Packaging

Thermoelectric Transistor Cooler

For use with TO-3 and TO-41 transistor cases, Frigistor, a new thermoelectric cooling module with high pumping capacity, is easily fitted since it conforms to case shapes. With three thermoelectric sides, the unit pumps heat out to a chassis, to fins, or to a heat sink. At maximum current, the cooler will pump 4.25 watts minimum across a temperature difference of 0°C; at zero watts load, it will provide a temperature difference of 65°C or more.

Write No. 272 in Box on Inquiry Card

NEW MATERIALS

Low Density Resin

Based on a ceramic sphere that has been stabilized in epoxy to give minimum air voids and high structural strength Isochemrez 444, a new medium viscosity, low density epoxy casting and potting resin may be machined and cut to size. High volume of the spheres permits a density of 0.67 against normal-filled epoxy density of 1.45 or unfilled epoxy at 1.15, thus they give excellent savings in weight at no additional cost, according to Isochem Resins Co., Providence, R.I. The material's suggested applications include: light density, full protection of units in pots or cans; large bulk light weight castings; lowering the density of normal epoxies; packaging to resist shock.

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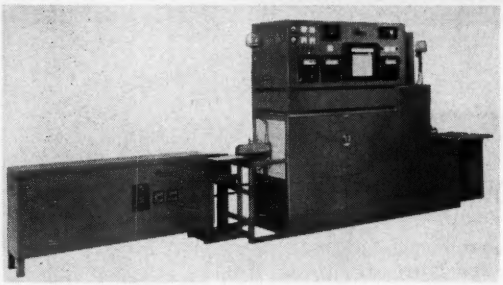

NEW EQUIPMENT

Zone Furnace for Alloying

For applications such as the alloying of germanium with indium, BTU Engrg. Corp's new controlled atmosphere furnace achieves a high rate of heat rise without overshooting, coupled with a precisely controlled alloying flat, and a precisely controlled cooling profile. Designated the HRH furnace, it provides controlled rapid heating rates up to 1500°C. per minute, (depending on load) and following this, alloying flats up to 1100°C. can be held to ±1°C. for any desired period of time. Cooling rates may be controlled down to 1°C. per minute or less. Specialized heat barrier, between the high temperature heat-up zone and the adjacent flat alloying zone, preventing any significant heat exchange, together with a special transfer mechanism produces a most desirable profile, according to the firm.

Write No. 263 in Box on Inquiry Card

NEW TECHNIQUES

O-Ring Templates

Drafting templates that aid in drawing cross sections and "spec-ing" O-Rings and O-Ring grooves are available from Parker Seal Co. The pocket size template is made of semi-opaque, non-glare plastic. Cut-outs for pencil points duplicate the cross section pattern of O-Rings and grooves in actual, twice and four times the size. AN and other sizes are printed right on the template which also carries dimensional, tolerance as well as other technical information. Cost is $1.00 each.

Write No. 258 in Box on Inquiry Card

CONFERENCES

Talk on Audio-Visual Aids

For those of you working in the New England area – the PGPEP group of the IRE has scheduled a Nov. 21st meeting on the subject of audio-visual production aids. James C. Perry of the Applied Communications Systems Div. of Litton, Inc. will discuss the techniques and equipment used in the preparation of production programs as well as the impact of A-V on output, quality control, degree of supervision required, worker and union acceptance and other significant factors. Dinner at 7:00 PM and meeting at 8 – Pillar House, Newton, Mass.

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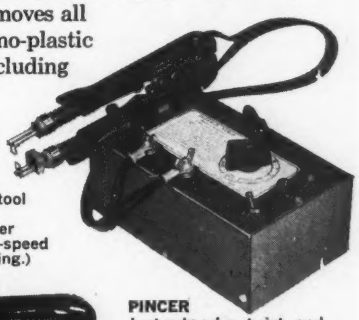

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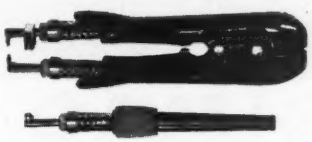

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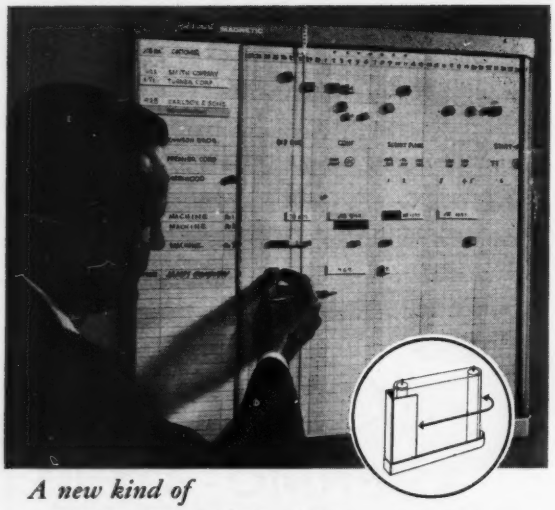

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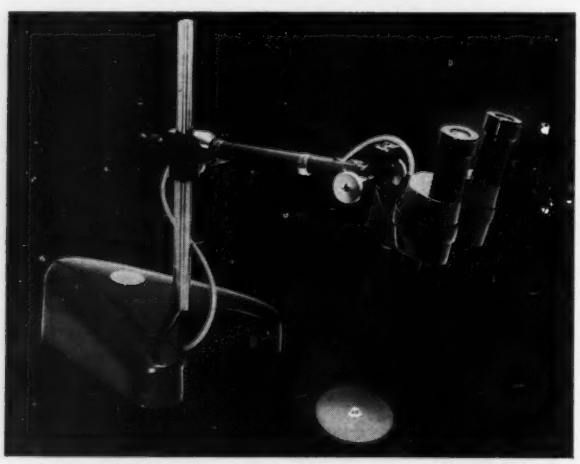

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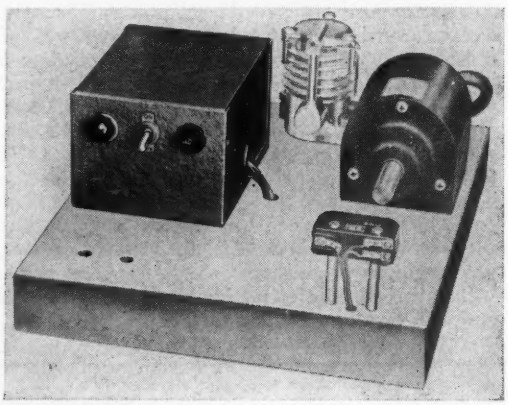

NEW EQUIPMENT

Machine Feed Control

For simplifying the use of automatic feeds for tapping machines, drill presses, punch presses, multi-spindle devices and others, Guardian Electric's feed control can be applied to electrical, hydraulic or pneumatic controlled automatic feeds. Unit requires a minimum of auxiliary control equipment for easy installation, utilizing only a standard limit switch and electrically operated valve. Said to replace costly controls using timers or motor thermal units, this new control does not require setting from job to job. Unit operates with a maintained jig switch and can be actuated manually or automatically. For automatic operation, insertion of the piece part into the positioning jig, equipped with a "maintained" contact, initiates the feed cycle. The machine feed cycles once for each piece part insertion. For maximum safety, feed will stop automatically if the part becomes disengaged from its proper position and will not re-cycle until the piece is correctly positioned. Control box can be equipped for either momentary or maintained control switches, or both. Unit can also be supplied with internal transformer for safe low voltage switching of the electrically operated valves.

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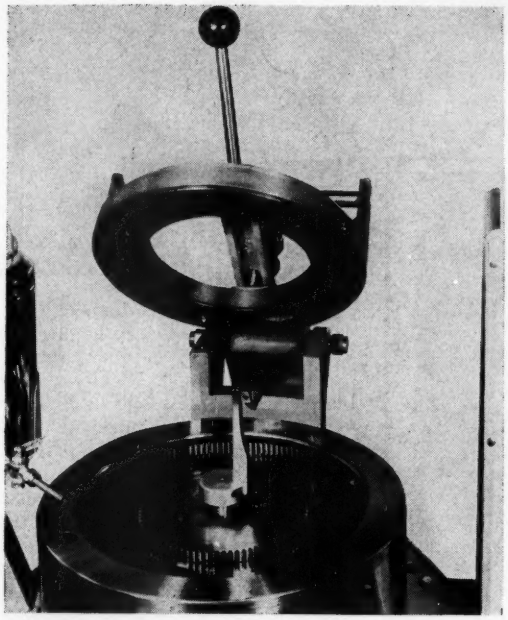

NEW EQUIPMENT

Semiconductor Polishing Machines

Two new precision planetary polishing machines for semiconductor processing produce flatness and parellelism to 0.000005", as well as an ultra-fine mirror finish in the order of ½ micron. Manufactured by Dallons Laboratories, Inc., L.A., Calif., the machines produce a mirror-like finish on one face of very thin semiconductor wafers, and polish both faces of heavier slices simultaneously. Model PPM-2875B features a wide 2⅞" track with a capacity of 10 carriers (work-holders), each with a capacity of from six ½" to one 1¾" slices. PPM-1875B has a 1⅞" track and will hold 17 carriers, each with a capacity from three ½" slices to one 1" slice. Upper plate and arm assembly of both machines may be raised manually and locked at the uppermost position, thus speeding loading and unloading. Both machines are extremely compact in size and noiseless in operation. Conveniently located master control panel contains all control for the variable speed motor, slurry mixer, coolant pump, etc., with indicator lights for each function.

Write No. 267 in Box on Inquiry Card

NEW LITERATURE

Sterilizing Semiconductor Parts

For contaminent-free non-oxidized surfaces, spheres, discs and base tabs, in semiconductor manufacturing, literature describes special cleaning techniques including high purity acid baths, high temperature vapor degreasing and high vacuum drying and complement inert atmosphere procedures to assure maximum component reliability. Semi-Alloys, Inc., Mt. Vernon, N. Y.

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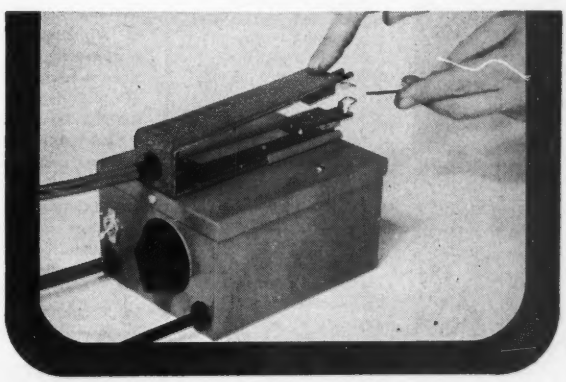

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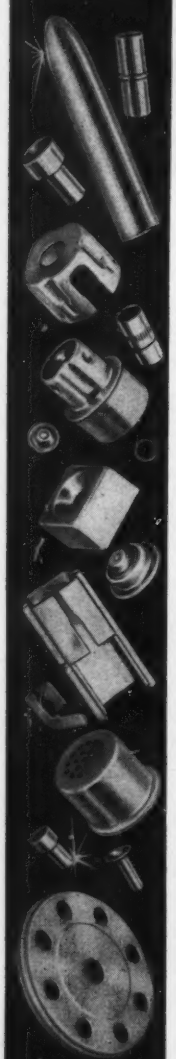

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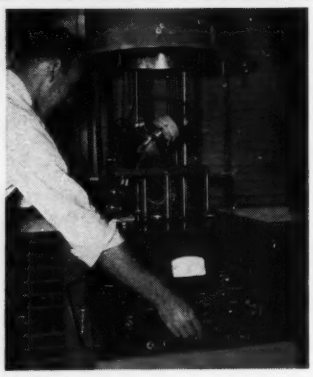


NEW EQUIPMENT

Evaporation in Microcircuitry

An electron gun and transport mechanism for the continuous evaporation of metallic, as well as dielectric materials, in the mass production of thin-film microcircuit elements, has been developed by Rescon Electronics Corp. of Waltham, Mass. Material to be evaporated is in the form of a continuous tape which is passed in front of the electron beam at its focal point. Temperatures in excess of 10,000° Kelvin are produced at the smallest spot size. The material transport speed is variable and continuously controllable and a complete set of beam controlling and monitoring instruments are also provided. Holes may be punched in the tape at the rate of 60 or 120 per second.
Write No. 284 in Box on Inquiry Card

NEW LITERATURE

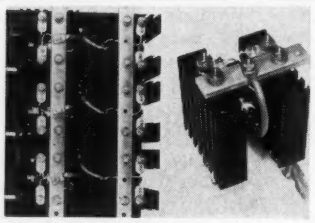
Plastic Protectors

Various applications and characteristics of non-shreading, easy to apply elastic polyethylene protectors are described in 4-page brochure. Protecting all threaded parts (both male and female), they may also be applied as a cap or plug to the ID or OD of tubing, thus insuring protection of valuable equipment during shipping, storage or manufacture. Molded-in seal ring gives extra-secure retention and sealing capacity. Alisco Co., Garden City, N. Y.
Write No. 293 in Box on Inquiry Card

NEW EQUIPMENT

Mask Cleaning

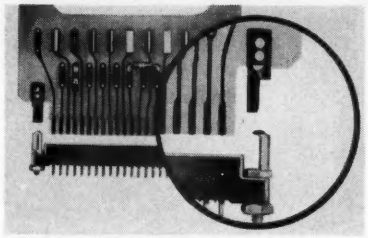
Filling a need for equipment that in size comes between two smaller agitation-type cleaners and four larger high pressure spray units, Conforming Matrix Corp. has developed a high pressure spray washing machine, Model W-1600, that cleans masks as large as 16" x 16" and holds but 5 gallons of cold strip solvent. According to the company, the unit cleans three times as fast as an agitation-type cleaner which requires 15 gallons of solvent. In the removal of accumulated paint, there is a saving of up to 50% in time and labor over that required by manual soaking, brushing and cleaning, the company reports. Unit also eliminates the fire hazards of open solvent-washing tanks or pans and averts the costly production delays found in hand scrubbings due to the damaging of the fine wire bridging. Every mask is thoroughly cleaned, including the smallest openings.
Write No. 256 in Box on Inquiry Card



ASSEMBLY PARTS

Bridge Circuit Heat Sinks

Specially designed for power transistors and silicon controlled rectifiers, Astro Dynamics' heat sink is an effective free convection unit available as a standard commercial item. Bus bars and mounting hardware variations permit a wide range of applications in the assembly of bridge circuits. Fin design optimizes the effective heat dissipation surface in the smallest volume, according to the company. Under a load of 75 watts, Model #2507 provides a thermal resistance of 0.68°C per watt.
Write No. 280 in Box on Inquiry Card



ASSEMBLY PARTS

Low-Cost Polarizer

Positive protection against incorrect insertion of circuit cards is provided by the Dot Polarite plug-and-jack assembly, a low-cost packaging component available from the Ucinite Co., division of United-Carr Fastener Corp., Newtonville, Mass. The device consists of a plug, assembled to the circuit board, and a jack, assembled to the edge connector. Discrete combinations are achieved through a patented method of aligning the hexagonal head of the plug so that it will be accepted only by a jack with the corresponding mating angle. Twelve discrete combinations are afforded by each jack and plug combination so that a pair gives 144 discrete combinations. Polarite plugs and jacks do not alter the integrity of the connector. Because they are constructed to standard machine-part specifications, the assemblies adapt readily to assembly-line techniques without the use of special tools.

Write No. 274 in Box on Inquiry Card

NEW TOOLS

Plasma-Gun

Only 5 inches long and weighing 3½ pounds, a new plasma gun, designed by Avco Corp., provides a practical, versatile production tool that is simple and reliable. Entire gun assembles with only 4 bolts securing precision-machined, self-aligning, piloted parts. All gun parts, including cathode and anode, are covered by the standard Avco warranty. The gun, Avco reports, will spray coatings – including refractories – with a controlled thickness, density, and bond strength that could never be obtained before; deposits a coating at twice the rate of comparable competitive models, and at savings up to 30 per cent over existing coating processes such as oxyacetylene flame-spraying.

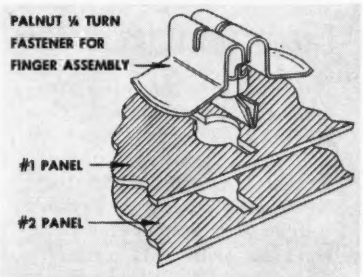
Write No. 277 in Box on Inquiry Card

NEW EQUIPMENT

Conversion Kits

Conversion kits from Kulicke & Soffa Mfg. Co. will change several of its precision instruments and production machines, now widely used in the semiconductor and micro-circuit industries, from manual to semi-automatic operation. With the kits, users of K & S Models 400, 401, 401AB and 402 Thermocompression Wire Bonders and K & S Model 310 Production Probe, can achieve higher production line output and greater quality control. Each conversion kit contains complete instructions for installation, and installation service by K & S personnel is also available. Delivery on all kits is from five to six weeks after receipt of order.

Write No. 266 in Box on Inquiry Card



FASTENING

Quarter Turn Fasteners

Two types of fasteners for finger or screwdriver assembly are used for blind fastenings such as attaching back panels of TV sets, refrigerators, washers; as latching mechanisms for access panels; for securing reflector panels to fluorescent lighting fixtures, and similar light-duty applications. Palnut Co., Mountainside, N. J. claims that both fasteners are much lighter in weight and lower in cost than existing quarter-turn fasteners. They are self-retaining in outer panel, avoiding displacement when assembly is opened. Both types feature a barrel shank to keep fastener centered in hole and to add shear resistance. Part No. QA50080 is designed for easy finger assembly and is locked and unlocked by pressing firmly with fingers and rotating 90° either direction. Part No. Z0001529 is assembled by pushing into panel holes, then inserting screw driver into fastener slot, depressing head and rotating 90°.

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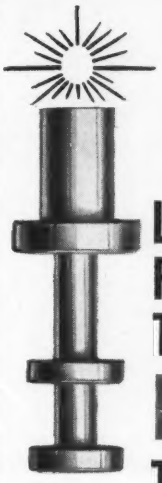
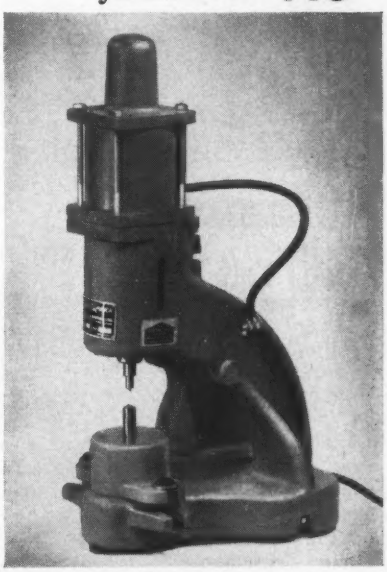


LOOKING FOR THE IDEAL TERMINAL SETTER?

STOP. *You've found it. A Black & Webster Electropunch or full automatic Electroset can solve your terminal setting problems* **$148.00** *—for as little as*



SHORT RUNS: Electropunch — *sets hand fed terminals twice as fast as conventional methods. All electric. Foot switch operated.*

LONG RUNS: Electroset — *automatically feeds and sets terminals up to 3600 per hour. All electric. Customized to your needs.*

WHAT'S YOUR PROBLEM?
Black & Webster can help. Send sample terminal and requirements.

Write today for free 14-page catalog describing our complete line of production tools.

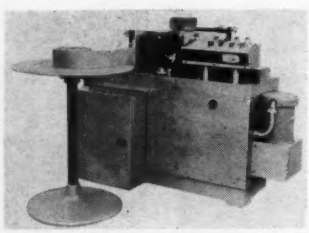
BLACK & WEBSTER, INC.
Dept. 6, 570 Pleasant Street
Watertown 72, Mass.
CIRCLE NO. 22 ON INQUIRY CARD

NEW LITERATURE

Terminal Blocks

Cost and space saving features of solderless terminal blocks for communications, data processing and broadcast equipment are described in a 4-page brochure. Male terminals on the boards mate with snap-on solderless terminals. Called Connecto-Block, the terminal block is said to reduce wiring costs up to 40%. Thomas & Betts Co., Elizabeth, N. J.

Write No. 252 in Box on Inquiry Card

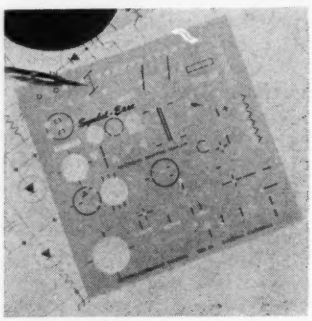


NEW EQUIPMENT

Stator Cuff Inserter

Accepting both large and small cuffs in the same cycle, Possis Machine Corp.'s Stator Cuff Inserter, SCM-45-2V, inserts up to 150 cuffs per minute — either square or round bottom. Starting with a paper roll, the machine rolls a cuff edge into the paper, feeds and cuts it, forms it into shape and inserts the formed insulation into the slot. Next, the machine indexes automatically, selecting either small or large slots in sequence, repeats the operation until all the slots in the stator are filled, then stops automatically. The improved Cuff Inserter loads quickly and easily from the top and adjusts for any stack height up to 4½" by simply changing the width of the insulation paper used. Expanding mandrel clamps the stator to the machine.

Write No. 259 in Box on Inquiry Card



NEW TECHNIQUES

Circuit Templates

Designed especially for semiconductor circuit drafting, electronic circuit templates provide the latest transistor and diode symbols in addition to those for electron tubes and electronic components. Symbols are in accordance with MIL-STD-15A, ASA and IRE standards for electronic and semiconductor graphic symbols and are sized for the 0.2" grid. Cutouts look like the symbols they make and are grouped for maximum convenience. All common symbols are made with horizontal motions of the template. Available from the Quintec Instr. Co., Altadena, Calif., the "Symbol-Ease" template is priced at $4.95.

Write No. 257 in Box on Inquiry Card

NEW LITERATURE

Marking Tools

Wide range of engraved steel lettering tools available for indenting, embossing, blind stamping, etc., are described in 14 page catalog. Included are complete specification pages, a removable, transparent, flexible lettering chart, check list for ordering, and a spectrum of marking processes for today's industrial part, component, product and package identification. Consolidated Stamp Mfg. Co., Inc., Markomation Div., Spring Valley, N. Y.

Write No. 254 in Box on Inquiry Card

NEW LITERATURE

Plastic and Ceramic Foams

Two new charts show the properties and uses of a variety of standard foam products of Emerson & Cuming, Inc. In addition, according to the company, a first-time tabulation of dielectric and physical properties of artificial and adjusted dielectric constant foams is presented. Foam sheets both rigid and flexible as well as a number of foam-in-place and pack-in-place syntactic foams are described.

Write No. 281 in Box on Inquiry Card

ASSEMBLY PARTS

Plug-in Cans

Low cost aluminum plug-in cans, from Vector Electronic Co., are 2" square with installed 8-pin octal plugs. Available in various standard heights of 2", 2½", 3", 3½", and 4", the units have 0.040" thick deep drawn bases and 0.020" thick covers attached with 3 side screws. An 8 pin mica filled plug is swaged into the can base. Cans are available with or without the various internal wiring structures.

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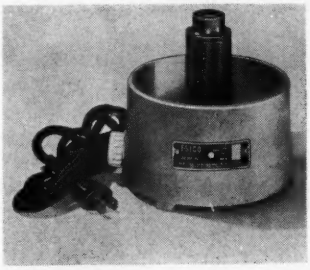


NEW EQUIPMENT

Electric Soldering Pot

For simultaneously stripping and tinning plastic insulated wire and leads on small parts, Electric Soldering Iron Co. has introduced their Model 875 soldering pot. Wattage is 150, maximum temperature 1,000°, and solder capacity is ¾ lbs. Inside dimensions are: diameter ⅞"; depth ¼" to 3½". It can be furnished with an adjustable thermostat for selecting and maintaining the best operating temperatures for precision production.

Write No. 262 in Box on Inquiry Card

NEW LITERATURE

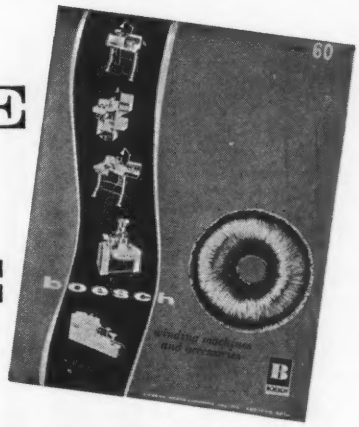
Spring Guide

"GUIDE TO LOWER ASSEMBLED COSTS FOR PRODUCTS CONTAINING SPRINGS", a new 16 page brochure, covers a unique custom packaging for various spring types to eliminate tangling and deformation, ease inventory counts and assure safe minimums, and facilitate production line dispensing. Another section of the guide illustrates new techniques and instrumentation for assuring quality levels suited to customer service and design needs, with resultant consumer savings. Third section describes procurement advantages stemming from single-source responsibility for a variety of component purchases normally associated with springs, including custom stampings, fasteners, and strip-stock or wire fabrications. Company's interplant coordination, the guide points out, provides freedom from supply interruptions, lower shipping costs and inventories, and is advantageous to users with multiple assembly plants buying through a central headquarters. Associated Spring Corp., Bristol, Conn.

Write No. 279 in Box on Inquiry Card

YOURS FOR THE ASKING

38 PAGE CATALOG



TOROIDAL COIL AND BOBBIN WINDING MACHINES

Coil Sizes: 1/32" I.D. to 14" O.D. Wire Sizes: #50 to #7 AWG. Complete specifications on the latest in coil winding machines, tape winders, and accessories are presented in exceptionally clear fashion. Included are tables and templates which make the proper selection of shuttles, sliders, shuttle heads, mandrels, and pulleys easy, quick, and virtually fool proof. Of value to engineers concerned with the design, and use, as well as manufacture, of toroids and other coils.

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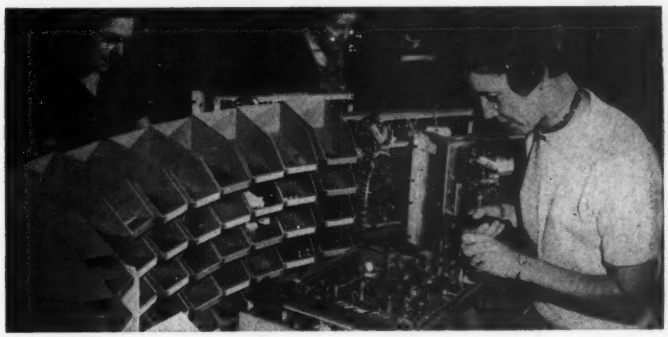

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Starting January, 1962

ASSEMBLING

Coaxial Connectors and Adaptors

Retaining the hermaphrodite feature of their standard 874's, General Radio Co.'s new locking connector is fully compatible with the non-locking types. When two locking connectors are mated, the threaded sleeve of either connector is screwed onto the threaded shell of the other. The sleeve of the second connector is backed off to a storage position. VSWR for both locking and non-locking versions is lower — up to 8 Gc — than the N, C, BNC and UHF types; also leakage is very low for the locking version and higher voltages can be tolerated for both types.

Instruments equipped with the new recessed-locking coaxial connectors can be fitted quickly with locking adaptors for a neat semi-permanent conversion to other connector systems, with a minimum of space added in front of the panel. This feature, reports GR, allows the equipment manufacturer to supply any type of connector quickly and easily.

Type 874 panel connectors are available in four basic types: standard non-locking connector that mounts in a 15/16-inch panel hole; a flanged-mounted non-locking connector as well as a locking connector and a locking recessed version, both flange-mounted. Each of these four types is available in several models to fit various popular coaxial cables.

Locking adaptors are now available to connect the Type 874 to Types BNC, C, N, SC, TNC and UHF plugs. Also available are standard, non-locking adaptors for plugs and jacks of the types mentioned, plus Types HN, LC, LT, UHF Rigid Line (EIA TR-134) and the ¾-inch-spaced binding posts and jacks.

Write No. 271 in Box on Inquiry Card

NEW MATERIALS

Lapping & Polishing Surfaces

Heavy duty, high density polishing chemotextile boosts abrasive performance in production lapping and polishing. Designated Pellon Pad by the Geoscience Instr. Corp., the semipermanent tool surface maintains flatness to ½ millionth of an inch and outwears hard metal laps by a factor of four, according to the company. They also report that costs are drastically reduced in finishing silicon, germanium, ferrites, laser rods, quartz and other electronic components.

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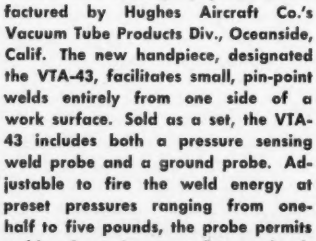


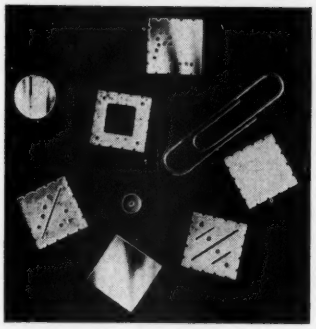
NEW TOOLS

Welding Probe

Pressure-sensing, pencil probe welding handpiece has been added to the line of electronic welding equipment manufactured by Hughes Aircraft Co.'s Vacuum Tube Products Div., Oceanside, Calif. The new handpiece, designated the VTA-43, facilitates small, pin-point welds entirely from one side of a work surface. Sold as a set, the VTA-43 includes both a pressure sensing weld probe and a ground probe. Adjustable to fire the weld energy at preset pressures ranging from one-half to five pounds, the probe permits welds of consistent quality on hard-to-get-at thin metal applications such as those encountered in high density electronic component assembly and strain gauge installation.

Write No. 285 in Box on Inquiry Card

Purchase Engineering



SOURCES OF SUPPLY

Glass & Ceramic Parts

At their new, enlarged quarters in Dobbs Ferry, N. Y., Zenith offers expanded facilities for the manufacture of miniature and micro-miniature parts for electronic and optical applications in addition to their expanded high vacuum coating and metallizing services. Materials such as glass, quartz, ferrites, germanium, etc., can be fabricated to very rigid tolerances. Dimensional tolerance of ±0.0005" are maintained on size of apertures and spacings. Specialized processes enable Zenith to fabricate high-precision glass, quartz, or pyrex parts for use in micro-miniature printed circuitry.

Write No. 656 in Box on Inquiry Card

NEW SERVICES

Wire Coding

Manger Electric Co., Stamford, Conn. announced new services available: two-sided printing and circumferential printing of plastic sleeving. New ink coding equipment was purchased for this service and additional equipment was also obtained to expand wire-stripping facilities. Company now offers center-stripping, miniature terminating, miniature wire stripping, counterstripping, circumferential printing, and a new wire and cable identification system coded and carded for customer requirements.

Write No. 652 in Box on Inquiry Card

NEW SERVICES

Microminiature Assemblies

For reducing convential solid state assemblies to microminiature equivalents only 5% as large as the originals, Manufacturing Laboratories, Inc., has three types of services available to manufacturers of electronic equipment: design of microminiature packages from schematic circuits, manufacture of microminiature assemblies and subassemblies and microminiature wafers with pre-deposited circuits for those manufacturers that have their own micro-assembly facilities. Manufacturing Labs provides a complete design service — from component layout and component wafers to subassembly and assembly packaging. The manufacturers' own circuit designs are utilized and the standard components are replaced with microminiature equivalents: These assemblies are then assembled with special manufacturing techniques can be supplied in either open or fully encapsulated forms.

Write No. 655 in Box on Inquiry Card

NEW SERVICES

Environmental Testing

Singer-Bridgeport, div. of Singer Mfg. Co., has made available environmental testing services which include planning and development of test programs, preparation of test proposals, evaluation of experimental models, qualification testing, quality control of production models, reliability testing, design and construction of special test equipment and complete reports to Mil. spec. All industrial and commercial testing is performed in accordance with the specification control drawings and test specifications of the individual client manufacturer.

Write No. 651 in Box on Inquiry Card

SOURCES OF SUPPLY

Ceramic-to-Metal Assemblies

National Beryllia Corp. has completed installation of facilities enabling it to supply high-purity beryllia and alumina shapes metallized and plated on one or more surfaces, printed circuits on beryllia or alumina, and brazed ceramic-to-metal assemblies, to MIL and customer specifications. Beryllium oxide couples high thermal conductivity with excellent electrical insulation properties.

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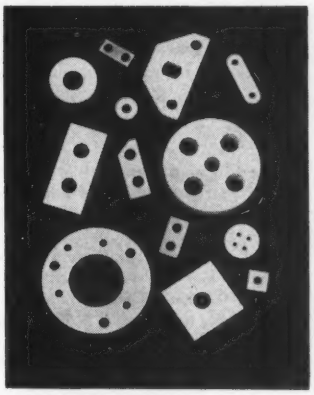

PRICE REDUCTIONS

Molded Parts

Improved precision-molding techniques permitted Mycalex Corp. to reduce the cost of electronic parts molded from Mycalex or Supramica. Jerome Taishoff, President of Mycalex Corp. of America, announced that savings on some parts run as high as 84% of former price quotations. Mycalex 410 glass-bonded mica and Supramica 555, 560 and 620 "BB" ceramoplastics are most valuable for producing such dielectric parts as relay spacers and motor end plates. Parts with a small amount of contouring, or with small male or female excursions in topology, can also be produced on presses using the new method. Complex and involute shapes such as coil forms continue to require the older and more complicated molding method, as do most parts into which metal members must be molded. Part characteristics of reliability, dielectric strength, low loss mechanical strength, thermal endurance and dimensional stability still are unchanged; only reduced cost results from the new molding method.

Write No. 654 in Box on Inquiry Card

NEW EQUIPMENT

Relay Testing

Described by engineers as an invaluable new tool in measuring critical time characteristics of relays, Leach Corp.'s new digital relay timer is said to provide an invaluable accessory to all phases of relay design, production and utilization. Typical applications include production testing, receiving inspection testing, engineering development and maintenance of equipment that utilizes relays.

Up to now, Leach points out, the most popular measurement technique has involved the use of a cathode-ray oscilloscope for displaying the various test phenomena, including such parameters as operate and release times, travel (transit) times and bounce times for individual contacts. This technique, reports Leach, requires a skilled operator to interpret the results and is limited in accuracy. Another technique, the use of a digital reading time interval meter, is a considerable improvement for measuring operate and release times, but is not satisfactory for measuring contact bounce time, according to the company.

However, the new Digital Relay Timer is said to offer a unique solution to all test problems by providing a fast, accurate, yet economical method of time measurement. It consists basically of a precision time reference, digital counter, digital integrator, logic circuitry, and controls and displays necessary to the mechanization of the time measurements.

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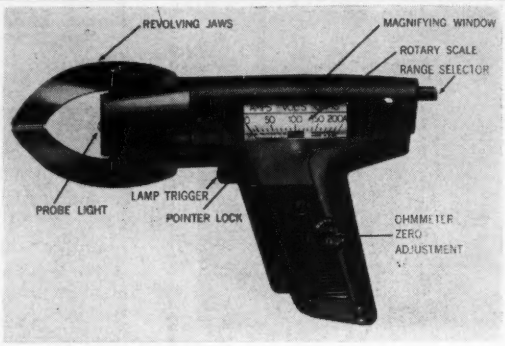


NEW EQUIPMENT

Testing "Western Style"

Difficulties measuring current, voltages and resistance, and testing circuits in inaccessible areas can be overcome with a lightweight, one-hand operable "Pistolmeter" introduced by Federal Pacific Electric Co., Newark, N. J. Revolving jaws at the muzzle-end can be inserted into cramped quarters at any convenient angle and the trigger-operated probe light at the meter's end ensures safe, easy handling. Locking device on the meter pointer enables the user to make his reading after the instrument has been removed from the tested conductor.

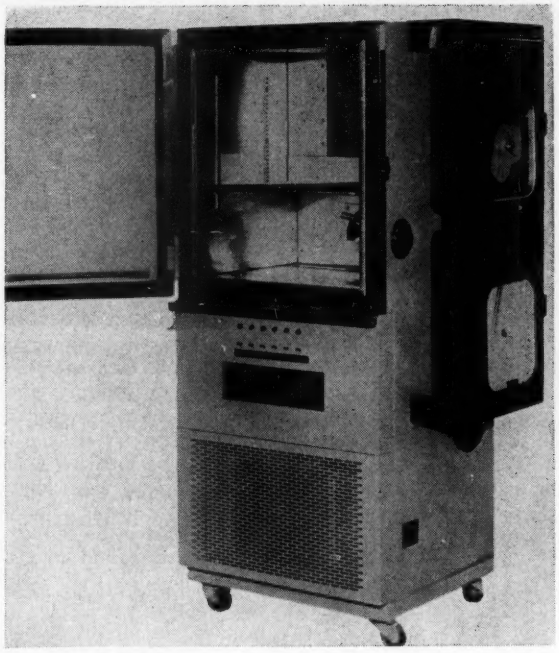
This versatile new tool has a color-coded rotary scale with four current ranges – 0-15/60/200/600 amps; two voltage ranges – 0-150/600 volts; and two ohmmeter ranges – 0-500/5000 ohms. Magnifying window on the meter scales minimizes error and speeds up readability. Accuracy and long life are assured by its sturdy casing, printed circuitry and a coremagnet movement. Rechargeable battery reduces maintenance costs.

Write No. 328 in Box on Inquiry Card

NEW TOOLS

Metal Parts Inspection

Edge of a one-cent coin gives some idea of the smallness of the miniaturized search coil developed at Battelle Memorial Institute, Columbus, Ohio. It is used in surveying and inspecting metal parts, such as extremely small electronic components and mechanical gears. Loop of induction coil at the end of the probe consists of 200 turns of insulated wire about one-third the diameter of a human hair. The wire, 0.00065 inch in diameter, is wound around an iron core that is 0.0008 inch in diameter. Using the search coil, one can measure eddy and induction currents and, thus, pinpoint physical defects and property variations in small and inaccessible parts.



NEW EQUIPMENT

Temperature-Humidity Test

With a large test space of 5.1 cubic feet in a compact cabinet, a new environmental unit provides temperatures from 0° to +200°F and relative humidity from 20% to 95% in the dry bulb range, limited only by +35° to +185° dew point. Applications include corrosion testing of metals as well as humidity effect on electronic components. Temperature lowers from +70° to 0°F in approximately three-quarters of an hour and rises from +70° to +200°F in approximately one hour. Manufactured by Tenney Engineering, the Tenney–Mite TH test unit can be mounted on casters for easy movement and requires no auxiliary equipment.

Write No. 327 in Box on Inquiry Card

Electrical Tests on Assemblies

Production testing of electrical assemblies and components, such as motors, heaters, transformers, resistors and cables, for high voltage breakdown, continuity and resistance is performed with a new Model 8522 Test Set, developed by Associated Research, Inc., Chicago 18, Ill. High voltage breakdown tests are made at any value from 0 to 2.5 kv, ac, with automatic readout of leakage current above a preset level and insulation breakdown, on separate signal lights.

Continuity and ohms resistance are indicated on direct reading scales of 0-50 and 0-500 ohms. Signal lights provide high speed readout of units with resistance above or below preset limits of tolerance. Readout circuits for leakage current, insulation breakdown, and resistance tolerance provide actuation of external mechanical reject mechanisms for fully automated test facilities.

Model 8522 is enclosed in a metal cabinet, operates from 115 v, 50/60 c ac, and quickly sets up for varying test requirements, since it is self-calibrating.

Write No. 338 in Box on Inquiry Card

In-Coming Inspection of Transistors

For fast, accurate testing of h_{FE} by inexperienced operators, Fairchild Semiconductor, Mountain View, Calif. has developed a transistor test set, designated Type 840-1, that provides a direct reading digital presentation of beta from 2-999 with an accuracy of ±2% or 1 digit, for both NPN and PNP transistors. Because of the speed of operation, set-up and programming, the new tester is said to be ideal for incoming inspection operations where a variety of transistor types are received in small lots.

Setting collector current and voltage on direct-reading decade control panel easily programs the unit. Allowable collector currents range from 1 microamp to 1 amp in 1 microamp steps and collector voltages from 1-29 volts in 1 volt steps. Effects of junction heating are overcome by using a low duty cycle (less than 1%) power pulse. A 350 microsecond pulse with measurement delayed for 300 microseconds insures consistent measurement. Duty cycle is adjustable to suit individual requirements.

After programming, the operator simply inserts the transistor leads into the test socket and depresses a test button or foot switch, and h_{FE} appears on a digital readout panel. A built-in, automatic "short" detector prevents damage to both the equipment and the unit under test. Test set is priced at $4975.

Write No. 334 in Box on Inquiry Card

Measuring Magnetic Phenomena

Capable of evaluating samples of magnetic films as thin as 10 micro inches, a Magneto-Tracer, from Halex Inc., El Segundo, Calif. measures the B-H hysteresis loop of small samples of material. It also checks wire and other bulk material, and is suitable for continuous testing of products such as single layers of standard oxide-coated tapes for tape recording and data processing. and for various films and coatings, including those produced by electroplating, vacuum deposition and other processes. Model 750T, available either with or without an oscilloscope, utilizes a specially-designed liquid cooling system which surrounds the sensing coils thus overcoming temperature sensitivity and permitting continuous operation. Magnetic fields up to 1,000 oersteds can be developed with higher ranges available on special request. Delivery can be made within 60 days; price without oscilloscope, $5,230.

Write No. 339 in Box on Inquiry Card

NEW LITERATURE

Electronic Balances

Complete line of low-weight range automatic electronic balances for check weighing, sorting, statistical evaluation, and production control is described in a new catalog offered by Mettler Instrument Corp., Princeton, N. J. Catalog demonstrates how objects, such as mechanical parts and electronic components, fall into predetermined weight categories, and according to preset relays in the control unit, may be sorted by operation of a flap or gate. Tabulating is accomplished by automatically counting the objects which fall into desired weight categories. All functions may be performed together for complete process automation.

Write No. 341 in Box on Inquiry Card

NEW LITERATURE

Surface Inspection

Described as an ideal reference guide and order book for inspectors, engineers, quality control people and purchasing agents, a 12 page general catalog covers a complete standard line of Profilometer instrumentation for the measurement and control of surface roughness. In addition to standard items, many special products are also described. Micrometrical Mfg. Co., Ann Arbor, Mich.

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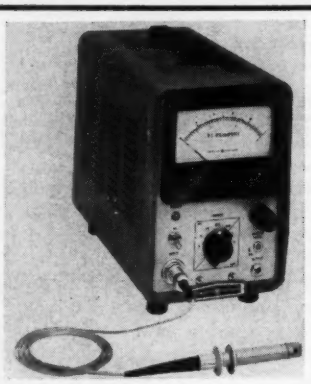

NEW EQUIPMENT

Clip-on DC Ammeter

Measuring direct current from 0.3 ma to 10 amps without interrupting or loading the circuits involved, Hewlett-Packard Co.'s ammeter features a unique probe which simply clamps around a wire in the circuit under test. Instrument handles most signals directly. To measure lower current values, several loops may be put through the probe, increasing sensitivity of loops. It measures dc in the presence of ac signals, and it also measures sums or differences of currents in separate wires. An output voltage proportional to meter deflection is available at the front panel for driving recorders or for making low frequency measurements.

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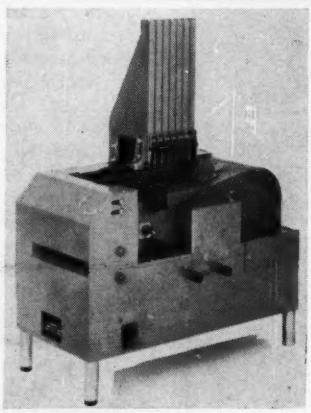


NEW EQUIPMENT

Axial-Lead Component Sorter

Test-Amatic, a new sorter developed by Develop-Amatic Engineering Co., sorts any like axial-lead components according to each unit's electronic value. The new automatic device consists of an input hopper, a testing station and three or more receptacle bins. Each component is transported automatically from the hopper to the testing station, where the component's electronic value is compared with a pre-set standard. If its value is within the desired tolerance limits, the component is deposited in the first bin; if above tolerance, it goes to the second bin; if below, to the third.

When used to sort incoming standard lots, Test-Amatic enables the user to pick out the most accurate components for high-precision specifications while weeding out unacceptable units. Originally designed to sort resistors, the unit easily adapts to any axial-lead components, such as diodes, capacitors, etc. Operating speed depends on the type of component under test; sorting resistors in standard, sequenced operation, Test-Amatic handles 3396 units per hour, one every 1.06 seconds. According to the manufacturer, it is the only device of its kind commercially available. Standard Test-Amatic does not include comparison apparatus, but any appropriate commercial go-no-go comparator can be used with it to provide the comparison standard. On special order, the Test-Amatic can couple with electronic intelligence.

Write No. 332 in Box on Inquiry Card

NEW TOOLS

Pigtail Grabber

Semi-Automatic fixture simultaneously seizes both pigtails of diodes, transistors, capacitors, and resistors, then makes secure low-resistance electric-test connections with no danger of bending the leads or breaking them off. Spring-loaded jams, 1½ inches apart, are opened by pressing a handle or a treadle; the part to be tested is dropped into the fixture; and the jaws close firmly on the wire leads when the operating handle is released.

There is no strain on the pigtails at any time, so operation is rapid and safe. The gripping jaws work separately to compensate automatically for difference in wire size or position, and the spring-tension on the jaws can be individually adjusted. Available from Precision Metal Prods. Co., the fixture requires bench space of only 3¼ x 3¼ inches.

Write No. 336 in Box on Inquiry Card

NEW LITERATURE

Resistor Manufacturing

An extensive line of specialized automatic machinery for testing and producting film type resistors is described in a catalog from Industrial Instruments, Inc. Production rate and accuracy, and feeding and handling methods for both leaded and unleaded resistors are covered. Available from the company are two resistor helixing lathes, which can be modified to meet individual requirements, for helixing metal, carbon, and oxide films on glass or ceramic resistor banks. Electronic controllers, a semi-automatic final tester and a 27-station unleaded resistor sorter are also described.

Write No. 335 in Box on Inquiry Card

Semiconductor Dice Sorter

Savings of up to 80% labor costs in dice/wafer gaging and sorting are possible with the use of their Auto-Sorter, reports Techni-Rite Electronics, Inc. Eliminating all manual operation, the

TK-500 model feeds the tiny dice automatically and gages and sorts 2400 to 3200 per hour, to an accuracy of 0.000040", into 10 categories ranging in sizes from 0.000050" to 0.0002", including "rejects" and "re-inspects". Various automatic controls, counters and shut-offs are standard equipment for maximum flexibility and convenience. Price is $10,500.00. 4-page bulletin gives complete information.

Write No. 337 in Box on Inquiry Card

NEW EQUIPMENT

Continuity Checking

Wiring errors in computer assembly promise to be virtually eliminated through use of a new continuity checker, called Witness, developed at Autonetics, a division of North American Aviation, Inc.

Use of the Witness equipment standardizes and sequences the assembly build-up configuration and because of its design simplicity, operator training time is reduced to a minimum, Autonetics reports. An assembler, for example, is concerned with only two points of termination at any given time in his wiring procedure. By limiting the continuity checking to two points, confusion and misinterpretation are eliminated when multiple termination circuits are encountered.

Under the old system, many wires were installed before continuity was checked to discover wiring errors. With Witness the assembly is continually checked as each wire is installed, greatly reducing costly rework and resultant system degrading.

Write No. 340 in Box on Inquiry Card

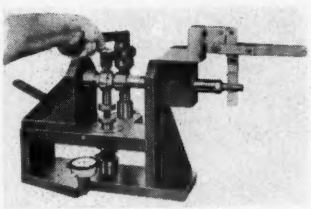
Hi-Speed Component Testing

For manufacturers and/or users who handle electronic components in quantity, an automatic testing-recording system, called Smart, from Texas Instruments, measures up to 16 different dc parameters and records the data within 12 seconds.

Up to 300 transistors may be tested per hour using all 16 parameters; however, on most testing runs, where fewer parameters are used, upwards of 500 semiconductors/hour could be handled easily. You may record actual parameter values or set the machine for rejection limits only.

The Smart system works into an IBM 526 Summary Punch, or similar digital device, which records test data in three digit readings on the standard 80-column IBM card. Twenty-seven digits are available for preliminary data regarding lot number, date, type, etc. Counter provides five digit numerical sequence of units. Time required for three digit readouts is approx. 200 ms. Many auxiliary consoles available from Texas Instr. give Smart added versatility.

Write No. 342 in Box on Inquiry Card



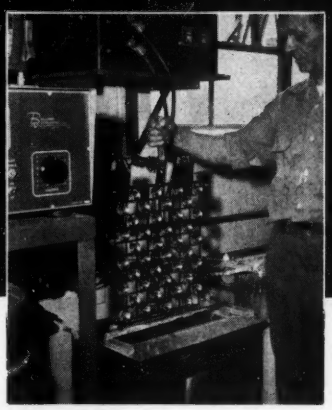
NEW EQUIPMENT

Bearing Test For Radial Play

Developed for measuring radial play in ball, roller and self-aligning bearings, Southwest Products Co.'s (Monrovia, Calif.) bearing test apparatus checks radial play in anti-friction bearings of 5mm bore to 38mm bore and other models to 153mm bore. It handles self-aligning bearings in a size range from 1/8" bore to 1.50" bore and other models to 6" bore. Simple and easy to operate, the unit measures 14" long by 12" wide and 12½" high and is suitable for bench use in quality control inspection. Spring gage permits a constant pressure reading for each bearing. Gage registers in increments of one tenth of a thousandth inch. Usage is applicable to all types of bearings containing an inner and outer race.

Write No. 329 in Box on Inquiry Card

ULTRASONIC CLEANING CUTS REJECTS TO LESS THAN ¼%



A rack of precision reflectors is removed from a side-mounted ultrasonic tank at the Foremost Manufacturing Co.

Mr. Herb Schiller of Foremost Manufacturing Co., Maplewood, N. J., manufacturers of precision metal reflectors states: "Since we installed Branson ultrasonic cleaning equipment our rejects have been reduced from 8% to less than ¼%. Our ultrasonic cleaning equipment is extremely reliable. Branson's excellent service has certainly helped to make our operation even more efficient."

Ultrasonic cleaning achieves a high degree of cleanness far beyond the range of other methods. Although cleanness is still important, there are additional advantages to ultrasonic cleaning. These are:

- Reduced cleaning time
- Cost reduction through labor savings
- Process simplification

Whether your products are small or large, simple or complicated, you owe it to yourself to investigate the use of ultrasonic equipment for your company. Branson's highly experienced, factory-trained specialists stand ready to assist you anywhere in the U. S. Tell us about your particular problem and Branson's engineering department shall try to find the best possible solution in the shortest possible time.

SINCE 1946 — THE RESPECTED NAME IN ULTRASONICS

BRANSON INSTRUMENTS, INC.

Ultrasonic Power Division

95 Brown House Road, Stamford, Conn.

CIRCLE NO. 29 ON INQUIRY CARD

Microminiature diodes, protected by IBM's new glass film technique, are on a greatly magnified portion of a small silicon wafer. One of the diodes is framed in the eye of a small sewing needle. High temperature process seals more than 1,000 devices simultaneously.

NEW TECHNIQUES

Glass Seals-In Reliability

A technique that holds promise of overcoming many cost and reliability problems inherent in producing microminiature devices is a high-volume method of sealing developed at the Components Div. of IBM Corp.

With intense heat of over 1500°F., the new method produces a protective film of glass only one ten-thousandth of an inch thick. The high-volume advantage comes in the simultaneous sealing of thousands of microminiature diodes and transistors which are so small that a thousand are cut from a silicon wafer the diameter of a nickel.

With conventional methods, individual "chip" transistors or diodes, in some cases, get initial protection by being "passivated," or covered with a thin layer of silicon oxide before the wafer is cut apart. This layer of oxide offers some protection, but not enough for satisfactory reliability. One conventional way of increasing the protection is to encapsulate each chip separately in plastic or glass made at relatively low heating temperatures. Another way is to enclose single chips or assembled multichip circuits in hermetically-sealed metal containers. However the IBM technique eliminates the need for either the separate chip encapsulation or the metal containers.

With the new method, conventional fabrication of diodes or transistors on silicon wafers is followed by the oxide coating process, and at this point, a special glass powder is applied to the oxidized surface, and the entire wafer is fired at more than 1500°F. The result is the microscopically thin film of chemically resistant glass with a smooth, pinhole-free surface. The wafer is then cut with an ultrasonic "knife" into the tiny diodes or transistors, each retaining its permanent glass seal. Electrical contact to the devices is made through small holes etched through the glass and oxide.

Dr. John A. Perri, Dr. William A. Pliskin, Dr. Jacob Riseman, and Mr. Herbert S. Lehman, all of IBM's Components Division, Poughkeepsie, N. Y., presented a paper on the new development at the Electrochemical Society Semiconductor Symposium. Their conclusions indicate that the protection obtained with this glassing process is comparable to and probably better than that obtained by hermetic sealing of devices in cans. It is obvious, they stated, that transistors and silicon devices can be protected by using this process. In fact, they added, glassed transistors have been made in IBM's Laboratories.

As for its importance in cost reduction and further microminiaturization, the authors believe that the new technique allows the use of diodes and transistors directly in a circuit module without placing them in protective cans. It also becomes possible, they said, to extend the device terminals onto the glass surface, and to use this surface for wiring and as a substrate for passive devices. They also pointed out that the batch nature of this new process, in which hundreds of devices are coated on one operation, will further help to reduce costs.

Write No. 479 in Box on Inquiry Card

NEW EQUIPMENT

Environmental-Controlled Production

Significant improvement in the reliability of hermetically sealed microminiature and sub-miniature relays will result, according to Norman Burstein, Vice President — Sales, Temperature Engineering Corp., Riverton, N. J., from the development of a system of environmental-controlled atmosphere enclosures housing ultrasonic cleaning tanks in conjunction with ultra-pure water-rinse tanks, vacuum bakeout-degassing stations, and a station in which relays are hermetically sealed. This system is being manufactured for Automatic Electric, Northlake, Ill. to meet stringent design and operation specifications necessary to produce hermetically sealed high-reliability-type relays, free from the danger of failure caused by moisture and particle contamination.

Temperature Engineering's system, which will enable operators to handle final assembly of micro-miniature and sub-miniature relays from start to finish, is itself located within a room which has a particle- and humidity-

controlled atmosphere. Automatic Electric expects to begin manufacturing high-reliability relays, utilizing Temperature Engineering's system, this year.

Write No. 481 in Box on Inquiry Card

NEW TECHNIQUES

Economical Life-Test Sampling

For evaluating long range transistor reliability and failure rate with much greater accuracy and economy, a new life test control plan is being employed by Philco's Lansdale Division. The technique permits use of small sample sizes without loss in statistical confidence to the user.

According to William P. Cole, Philco's director of semiconductor reliability and quality control, the commonly-used method of employing excessively large sample sizes to estimate reliability of each transistor lot is not only expensive for the customer, but totally unnecessary in many cases. Though such testing may tell something about the individual lot sample, he explained, nothing is revealed about preceeding or subsequent lots.

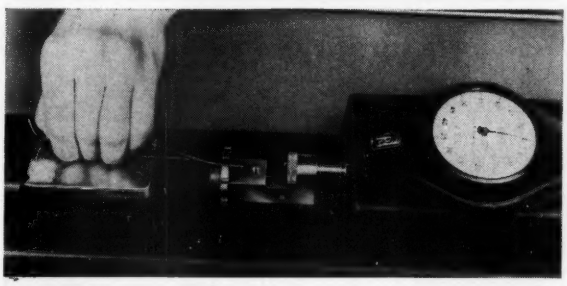
As a result of automated production lines and mechanized in-process control, Philco has been able to obtain the product uniformity which makes sequential life test sampling possible. Basically, the plan involves three items: life test control charts, sequential sampling plans and a cumulative plan with provisions for continual qualification.

Accumulated life test results obtained from successive lots are plotted in a fashion which reveals the degree of product uniformity as well as the potential reliability level. This permits the determination of the qualification level. For each reading period, the number of failures are plotted for each lot. Control limits based on probability statistics are established for each reading period. If the sample exceeds the control limit, then the product may not be shipped until the completion of the life test period. At that time the sample must be within the control acceptance limit as a criterion for release to the user. If the lot fails to meet the acceptance limit, then the failure product must again be requalified.

Cole stated that the plan contains provisions for early release of finished transistors, insuring prompt delivery and lower inventories. He explained that the savings involved in this plan not only result from the use of smaller sample sizes for each lot, but also from the possibility of maintaining lower finished goods inventories when it has been shown conclusively that the product is in statistical control.

Recognizing that a small sample on an individual lot will normally tell very little about the reliability level to a high degree of confidence, Cole said that Philco's method has demonstrated reliability at a high confidence level as result of a week to week and month to month product uniformity.

As a matter of fact, Cole explained, since the plan includes a graphic history of prior life test results, the user is able to detect any change in product reliability at a glance. While the statistical principles supporting various aspects of the plan are well known and have been used for other purposes, it is believed it represents the first such usage for purposes of transistor reliability evaluation.



NEW EQUIPMENT

Solderless Terminal Quality Control

To insure the tensile strength, and hence low electrical resistance, of every solderless electrical connection in the BMEWS data processing equipment built by the Data Systems Operations of Sylvania Electric, quality control engineers at Sylvania maintain a strict check on the performance of all crimping tools by daily tests performed on a standard test instrument especially designed for the purpose. This tester, called the Hunter Terminal Pull Tester, is manufactured by Hunter Spring Co., a Division of American Machine & Metals Inc., Lansdale, Pa. It consists of a precision dial-indicating force gage accurate to one-half of one percent of its maximum capacity, and an air motor, both mounted in-line on a common base.

Crimped terminal is inserted in the terminal holding fixture provided on the gage, and the wire leads are placed between a pair of jaws extending from the air motor. Terminal holding fixture is designed to accommodate AWG wire sizes 10 through 20. Depressing a button actuates the air motor, which closes the jaws and pulls the wire at a predetermined, controlled rate-of-speed. When the crimped connection fails, the gage pointer registers and holds the force reading at failure.

Since the test is destructive it was impractical, of course, to test the actual connections made in the computer itself. Therefore the Data Systems Operations' engineers established a statistical quality control procedure. At first, since no experience was available, absolute minimum tensile strength values were set at 10% greater than those permitted by MIL-T-7928. It was required that all test values obtained in control samples exceed these figures by 10% to insure not only that no substandard work would be performed but that any tendency of a tool to produce substandard work would be discovered before it actually did so. Tensile readings falling below these established values caused rejection of the tools, before it became necessary to reject the work. Lower and upper control limits for the daily average tensile value were established by conventional statistical methods. In every case the tensile averages were higher than the absolute minimum values because any sample having a lower value had been rejected. These limits were then used as a new basis for comparing the daily test values from each tool.

According to Sylvania engineers, the availability of a mechanically-operated tester specifically designed for the job not only reduced inspection time, but, by insuring testing accuracy, saved many times its own value in rework and scrap material costs – to say nothing of time lost in rework. In addition, since forces over 60 lb were involved, manual testing would have been time consuming and incompatible with production rates.

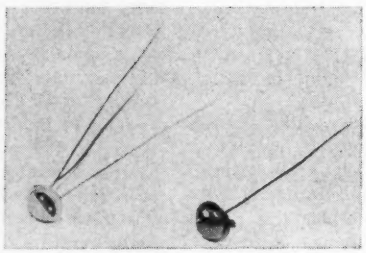
Write No. 477 in Box on Inquiry Card

ASSEMBLY PARTS

Transistor Header Design Eliminates 100% Testing

Transistor holder, introduced by Hermetic Seal Corp., allows a reduction in the overall height of hermetically sealed transistors to a maximum 0.093 inches in a header only 0.040 inches high. Replacing the glass beads in the transistor head, in which the conductors are embedded, with a recessed well of glass achieved this degree of miniaturization. Size of the beads required for hermetic sealing in conventional design heretofore has blocked miniaturization, according to the company.

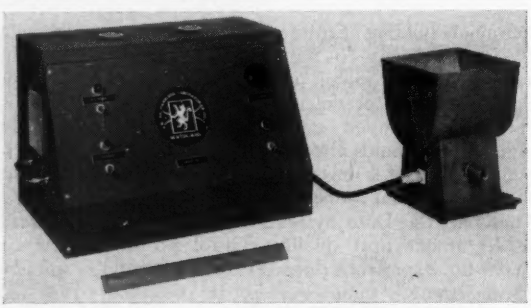
The conventional bead design, President Mannes N. Glickman explained, also allowed the use of so little glass for sealing that it was difficult to achieve vacuum tightness in volume production. Cost of tests for tightness under these conditions was prohibitive for most applications, he said. However, he added, the Hermetic Seal design eliminates the requirement for 100 per cent testing. The larger amount of glass accepted by the well shrinks on the application of heat and automatically effects vacuum tightness.



Hermetic Seal Corp.'s new transistor header in both incomplete (right) and completed stages.

Since strength also is a factor with most specifications calling for pull tests on the transistor pin, Hermetic Seal has developed a new glass with better flow qualities at high temperatures for use in producing the microminiature blocks. Glickman said that the chemical make-up of the glass has been changed to provide more effective bonding to metal. The company also has incorporated a nail head terminal configuration which facilitates the mounting of transistor components without reducing the IR characteristics of the head. Standard TO-18 heads will become available in microminiature sizes and in production quantities within 30 days.

Write No. 402 in Box on Inquiry Card



SERIES 751 ULTRASONIC CLEANING SYSTEMS

High power, high frequency for maximum effectiveness. High efficiency for maximum economy.

Specifications:

Supply; 115V, 60 cycles, single phase, 8 amperes
Output; CW; 700 watts peak.
Transducer; high temperature ceramic, focussed.
Thermostatic temperature control.

Prices:

751A with 5-quart tank $695.00
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Have you recently solved a production problem?

Did your solution involve new equipment? reorganization? new plant layout? change of engineering design? better purchase engineering control? Or maybe it was something as simple as a new adhesive? work holding fixture? assembly technique?

Whatever the solution, complicated or simple, you can help your colleagues by telling us what the problem was and how you solved it. For each published solution to a production problem germane to the field of E/E production engineering, you will receive the thanks of our readers and a cash honorarium of $25.00.

Address all communications to:

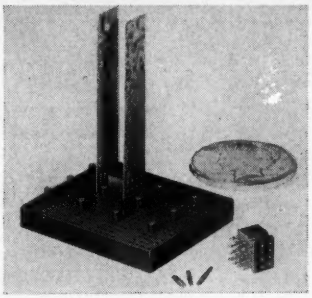
William Bolt, Associate Editor
E/E Production
167 Corey Road
Brookline 46, Mass.

NEW COMPONENTS

High Density Connector

As a significant step in miniaturization of components for the data processing field, with applications in airborne and missile units, National Connector Corp. has designed a micro module connector with 250 terminations within a size of approximately two inches by two-and-one-quarter inches. In addition, components may be mounted between 32 printed circuit boards.

Individual socket contacts terminate into a master printed circuit board or to individual wires by crimping or soldering. As an example of miniaturization, each contact will hold one ounce minimum and six ounces maximum withdrawal force with a 0.0316 inch diameter steel pin. After 100 insertions, the contact resistance will not exceed one ohm when mated. Pin contacts are 0.030 inches in diameter, or roughly three-fourths of the diameter of the wire in a standard paper clip.



Contacts are gold plated with 0.00005 gold over 0.0002 nickel. Socket contacts are of beryllium copper, heated treated for maximum properties, and are plated with 0.0001 inch minimum gold over copper flash. Eight connections are made on each board, sixteen connections on each plug assembly. Connector receptacle is polarized to prevent improper insertion of a plug. If desired, a mounting plate can be attached to the bottom of the header.

Write No. 407 in Box on Inquiry Card

NEW COMPONENTS

Push-Pull Switch

Eliminating the need for solder shields, a new push-pull switch saves up to 60% assembly time costs of wiring operations, according to Clarostat Mfg. Co., Inc. The Series AG switch for control/switch combinations provides better access to terminals during soldering operations. The usual rim holding the terminal board is eliminated thus increasing terminal clearance 300%, permitting complete soldering operations without the use of the solder shield.

Write No. 405 in Box on Inquiry Card

ASSEMBLY PARTS

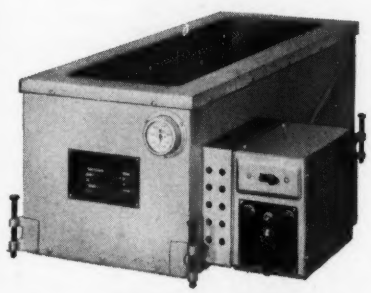
Solder Terminals

Cambridge Thermionic Corp. announced the development of 6 new solder terminals specifically for use in printed circuits. Use of less pressure for swaging, than with regular terminals, reduces danger of stresses in the conductor lines which may cause "lifting" during soldering. Shape of the flared terminals and swaging to funnel shape also permits relief of stresses. In addition, a greater area is provided for a fillet of solder, thus improving the bond. The 6 terminals include 2 straight shank and 4 flared shank, and all terminals are available for mounting on panels from 1/16" to 5/32" in 0.062" dia holes.

Write No. 406 in Box on Inquiry Card

DEE PRINTED CIRCUIT SOLDER POTS

Proven design with precise controls. Mechanical type dial thermometers to indicate solder temperature. Hydraulic thermostats. Walls and bottom of the solder cavities are smooth and free of all obstructions.



Temperature range 300° to 600° F. Temperature swing ±2°. Wide variety of sizes to eight feet long. All voltages.

Send for bulletin.

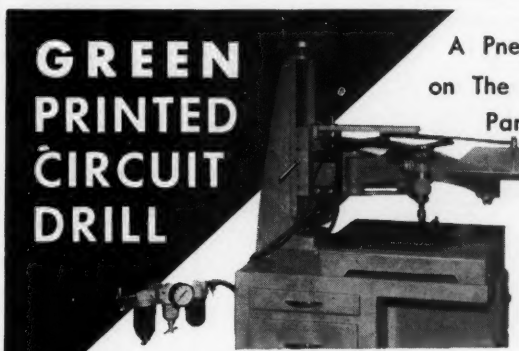
DEE ELECTRIC COMPANY

Dept. EE, 1708 W. Belmont Ave.,

Chicago 13, Illinois

CIRCLE NO. 32 ON INQUIRY CARD

GREEN PRINTED CIRCUIT DRILL



A Pneumatic Attachment on The Green Model D2 Pantograph Engraver rapidly drills holes in printed circuits by tracing templates.

- **Drill as many as 100 holes per minute, Foot switch actuates air powered operation.**
- **Drill speeds and feeds have independent adjustments. Feed regulated by air pressure.**
- **Spindle speeds up to 26,000 rpm. Permits use of carbide drills when required.**
- **D2-201 air attachment includes spindle air cylinder, regulating valve and pressure gauge, foot switch, filter and oiler, ready to operate when connected to compressor.**

The Model D2 Heavy Duty Pantograph Engraver features ratios of 2 to 1 to infinity. Unobstructed on three sides to handle large work. Micrometer adjustment for depth of cut. Vertical range 10" adjusting copy table automatically with pantograph.

GREEN INSTRUMENT COMPANY, INC.

295 Vassar St., Dept. 100, Cambridge 39, Mass.

FOR FULL DETAILS, WRITE, WIRE OR CALL

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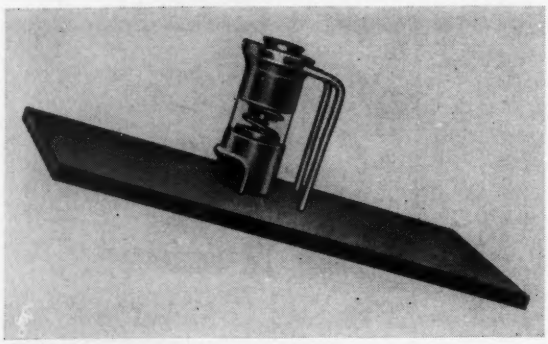
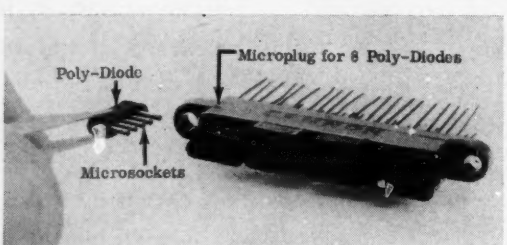


NEW COMPONENTS

Trimmer Capacitors

Vertical mounting of new piston type trimmer capacitors reduces materially the space needed for manipulating any trimming tools and allows flexibility in the placement of the units, resulting in more efficient packaging, according to the Atlas Div., Atlee Corp., Winchester, Mass. Made to meet or exceed the critical requirements of MIL-C-14409A, the Atlee Trimmer Capacitor is available in three standard pfd ranges: 8.5, 10, and 12.

Write No. 408 in Box on Inquiry Card



ASSEMBLY PARTS

Replace Printed Boards

By incorporating new micro-diode plugs into assemblies, soldering and printed boards are eliminated and assembly size is reduced. Connect-disconnect feature of the plugs allows not only a rapid but an almost flawless degree of assembly, maintenance, and servicing, according to Cannon Electric Co., L. A., Calif.

Cannon reports that Delta Semiconductors, Inc. of Newport Beach, Calif, uses the plug to form an ingenious diode matrix. Previously, Delta developed a Poly-Diode, consisting of four separate diode junctions each with an individual lead plus one common lead encapsulated in a package approximately the same size as a standard single diode. However, by substituting Cannon Microsockets in place of the leads, the Poly-Diodes are connected to the circuit by simply inserting them into a Cannon Micro-diode plug.

Write No. 409 in Box on Inquiry Card

ASSEMBLY PARTS

Epoxy Packages

Epoxy Products Division of Joseph Waldman & Sons, Irvington, New Jersey, report that they have come up with the first all epoxy module packages (header and cases) that fit 8 or 10 pin crystal can relay sockets. A friction fit between the header and the case prevents liquid epoxy from leaking during encapsulation. The cases are open at the top for easy filling in production line applications. Header pins can be either gold plated or tinned copper with a solder well or for wrap around connections.

Because both the header and the case are molded of epoxy, the module has excellent electrical and mechanical characteristics, the company stated. The module will withstand continuous operating temperatures of 400° F and with an epoxy encapsulant it will withstand temperature and humidity cycling in accordance with all applicable MIL specs.

Complete modules are available from stock without a tooling charge. Module prices range from 50¢ to $2.00 each, depending on header pin details and quantity.

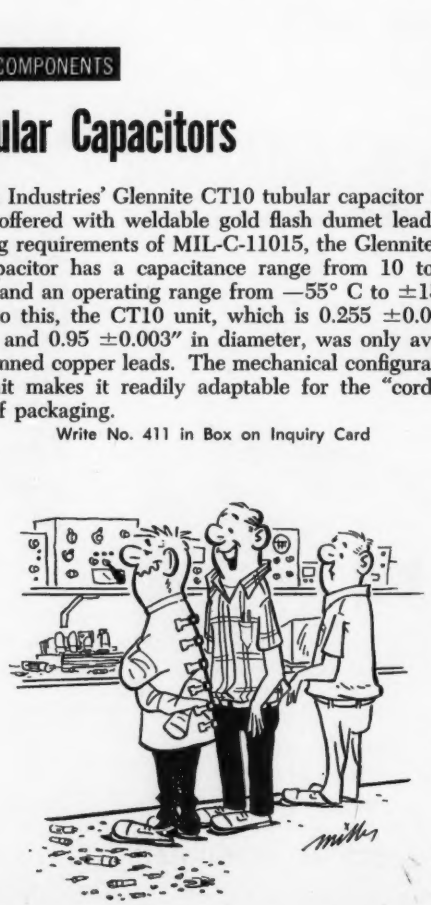
Write No. 410 in Box on Inquiry Card

NEW COMPONENTS

Tubular Capacitors

Gulton Industries' Glennite CT10 tubular capacitor is now being offered with weldable gold flash dumet leads. Exceeding requirements of MIL-C-11015, the Glennite tubular capacitor has a capacitance range from 10 to 1000 MMF and an operating range from —55° C to ±150° C. Prior to this, the CT10 unit, which is 0.255 ±0.010" in length and 0.95 ±0.003" in diameter, was only available with tinned copper leads. The mechanical configuration of the unit makes it readily adaptable for the "cordwood" style of packaging.

Write No. 411 in Box on Inquiry Card



"It was good of you to come back and finish that job, Harry."

Production Abroad

William Belt, ASSOCIATE EDITOR

The Japanese government is studying the advisability of raising limits on the shares U.S. and other foreign firms may hold in joint undertakings with Japanese business. The move is prompted by increasing pressure from the United States and foreign countries seeking greater shareholding ratios than 49 percent permitted by Japan's 1950 Foreign Investment Law. Where foreign partners want more than 50 percent, their contentions are based on two grounds: it is their extensive and expensive background research data that are being sought and royalties for technical know-how alone are insufficient. In some instances, foreign firms have found it advisable to secure management rights in joint ventures to insure security of their information. Others want a larger share to establish a firm hold on export markets for Japanese manufactured products. Whether the limits are raised or not will probably depend upon the extent to which Japan wants and needs the induction of foreign technical know-how.

If you are considering the establishment of a Japanese factory for the manufacture of engineering products, you will want to pick up some information about Japanese wages in comparison to wages in other countries. According to statistics of the International Labor Organization, Japanese cash wages in manufacturing industries averaged 26 cents an hour in 1957 compared to $2.70 in the U.S., 65 cents in Great Britain, 51 cents in West Germany, 44 cents in France and 33 cents in Italy. But these figures are for basic cash wages not including fringe benefits. And today's boom in Japan is probably well ahead of the figures reported here. An accurate wage determination is best made by your own survey.

The range of fringe benefits received by Japanese workers is, by American standards, extraordinary. They include: year-end and summer bonuses amounting to two to three months' pay, sometimes considerably more; family allowance; living cost allowance; length of service allowance; low cost housing provided by employers; payment for transportation to and from work; meals at extremely low price; skill and job status premiums; age differentials; clothing and necessities at large discounts; very low cost vacations; welfare services paid for in part or in full by the employer, including free medical treatment and payment of full salary indefinitely during illness; health and recreational facilities; health insurance; old age pension; unemployment and accident insurance; and finally, a lump sum retirement allowance (which averages three and a half years' salary) after thirty years of employment, the cost of which is borne entirely by the employer. If all of these fringes benefits were converted into cash, Japanese workers' income would be comparable to the income of workers in some European countries since these benefits often amount to as much as three times the basic wage rate.

Because the hourly wage cost does not take into consideration the productivity of foreign labor, it provides no real indication of differences in unit labor costs as was pointed out in the Chase Manhattan Bank's "Report on Western Europe" for June/July 1960. Their conclusions are applicable to Japan as well as to Europe:

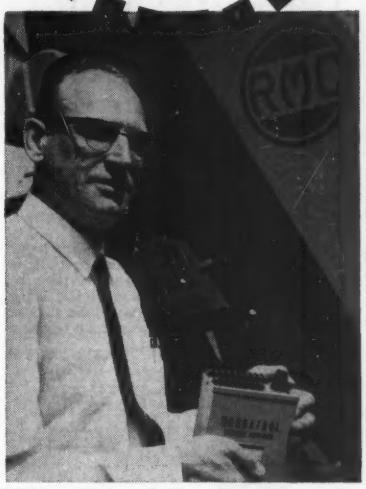
"U.S. business men considering investments in Europe should not be misled by the great differences in wage rates. While lower rates can help make it more adaptable to produce some products in Europe, this is far from being the general case.

"Hourly wage data may understate actual labor costs. The U.S. worker is supported by more capital equipment, increasing the amount of work he can do in one hour. . . . Other costs, such as raw materials, fuels, power and construction may be higher than in the U.S. It is overall unit cost that must be considered. Many products can be produced cheaper in United States despite much higher wage rates."

The greater part of Japanese exports such as metal goods, ceramics, sewing machines, transistor radios, cameras and watches is produced by the larger enterprises of Japan, paying higher than average wages.

(Continued on page 54)

Bistable Amplifier for static relay control



Richard B. Doorley, Mgr., New Products Div. Railway Maintenance Corp., Pittsburgh, Pa.

"Norbatrol helped us cut R&D time by 1 year with this Bistable Amplifier"

"Norbatrol's Bistable Amplifiers solved many control problems in redesigning our McWilliams Jack-and-Production Tamper from manual to reliable, automatic operation. Now this RMC railroad surface machine operates electronically—improves grade and cross level to accuracies never previously accomplished. And we got a bonus," Mr. Doorley continues, "these rugged, reliable static relays cost less than alternate systems."

You, too, can speed development and production time with the ultrasensitive Bistable Amplifier—it replaces mechanical relays in critical control and regulating applications. The Bistable incorporates silicon controlled rectifiers, magnetic amplifiers and attendant circuitry to give multiple inputs as low as 5 x 10^{-8} watts, fast response, high gain and a current output of 1 Amp at an 85° C. ambient.

GET THE FACTS on design and application data—write for technical bulletin CS60.

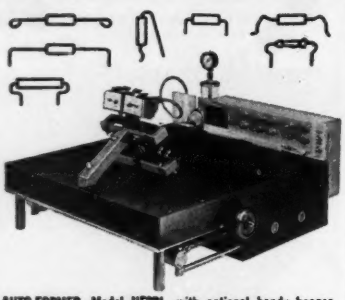
NE-1

NORBATROL Electronics Corp.

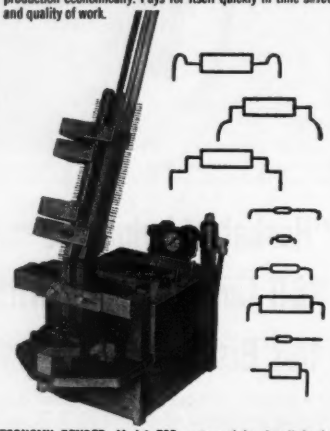
DEPT. H 356 Collins Avenue
Pittsburgh 6, Pennsylvania

CIRCLE NO. 35 ON INQUIRY CARD

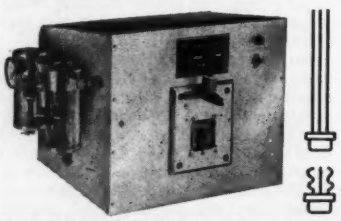
BOOST PRODUCTION
with FME
Automatic Machines



AUTO-FORMER, Model UF2RL, with optional handy hopper feed attachment, automatically cuts and forms pig-tails (leads of resistors, capacitors, etc.) up to 5000 per hour. This versatile machine will cut and shape any conceivable lead form on any component body with coaxial leads. Handles short-run production economically. Pays for itself quickly in time saved and quality of work.



ECONOMY BENDER, Model ECB, cuts and bends all leads automatically to any length up to 5000 per hour. Can be reset in minutes. Prepares leads of diodes and resistors for fast assembly in printed circuits or conventional wiring. Adjustable card feed chute permits rapid loading. Stellite tipped cutters assure trouble-free performance.



TRANSISTOR STRAIGHTENER, Models AL3S, straightens the long leads of transistors automatically at more than 1000 per hour, and ejects them from the machine. Leads are not rolled, twisted, or electrically affected in any way.

TRANSISTOR NOTCHER-CUTTER, Model AL3NS, straightens, notches and cuts leads automatically at more than 1000 per hour, and ejects them from the machine. Leads are shaped to fit or snap precisely into the proper holes of the printed circuit.

WRITE FOR DETAILED SPECIFICATION SHEETS TODAY.

DESIGN TOOL CO.
A Division of
Federal Manufacturing & Engineering Corp.
1055 Stewart Ave., Garden City, N.Y. • PI 2-7400

CIRCLE NO. 36 ON INQUIRY CARD

PRODUCTION ABROAD

(Continued from page 53)

PRODUCTION FOR NATO

The advisory group for aeronautical research and development of the North Atlantic Treaty Organization was told that microminiature electronic circuits in future missile and satellite systems will represent a marriage of a variety of microelectric techniques presently under development. Gerald J. Selvin of Sylvania Electric Products reported that no method of fabricating, protecting and interconnecting microelectric circuits is worthy of recognition unless it produces ultra-small electronics with superior reliability at prices which will ultimately be below those of today's conventional electronic equipment.

"Because the techniques and materials used in forming electronic circuit stages will continue to change as time goes on, we can expect a high obsolescence rate in equipment used to produce the electronic materials and circuits. But the method of protecting and interconnecting should not be obsoleted." Mr. Selvin noted that in this way we can justify an investment in automated assembly equipment at a very early date. Quality automated assembly, with the resultant reduction in hand labor, offers reduced prices and higher reliability.

On the basis of these conclusions, Sylvania has established microminiature module requirements for protecting and interconnecting circuitry that would accept mixtures of any and all techniques and would be prepared now for more advanced thin film and solid state developments as they become available. This approach is based on the belief that microminiature electronic circuits in future missile and satellite systems will represent a marriage of a variety of microelectric techniques presently under development.

Because there are as many different approaches to the microminiaturization of electronic circuits as there are organizations active in the field, the lines of attack range from present state-of-the-art techniques of fabricating and assembling very small individual electronic parts to long range and more radical application of multi-layer, vacuum-deposited thin films and solid state material and device technology. Sylvania's approach to the problem, as expressed by Mr. Selvin, is based upon their conviction that the electronic system requirements come first, that the system requirements imposed upon sub-systems and circuits come second and that the method of forming these circuits comes third. They try to avoid compromising electronic system performance just to use one exotic microcircuit construction technique throughout. Mr. Selvin was one of fourteen U.S. industrial and military representatives invited to address the conference at Oslo, Norway.

UNIVERSITIES VS. INDUSTRY IN THE USSR

The Ukrainian Institute of Machine Engineering and Automation is deeply concerned about the competition for the services of scientists and technologists existing between Soviet industry and Soviet universities. So far the universities are leading in this race for talent since they can pay a scientist three or four times as much as he could make as a researcher in industry. With a staff of 350 scientists and technicians, the Ukrainian Institute concentrates on reducing the time from drawing board to production line for various automatic instruments for Soviet industry.

In an article titled "From the Institute to Production" published in the *Ekonomicheskaya Gazeta,* an official of the Institute stated that it was very difficult to attract experienced mechanics and scientists since the universities can offer these men far more than industry can. A doctor of science serving as the chairman of a university department earns three to four times the salary he could draw working as the director of an industrial laboratory. "Is that proper?" asks *Ekonomicheskaya Gazeta,* and answers its own question: "Of course not."

They might possibly get a different answer if they asked American PhD's who have functioned as department chairmen at American universities. And we can tell the staff where to find these men; quite a number of them are functioning as directors of research and engineering in American industry — where they earn three or four times the salary they could as chairmen of departments at our universities.

You can read all about the problems Soviet industry is experiencing in the area of attracting, training and remunerating scientists in the paper "From the Institute to Production" translated by the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Included are nine other articles from various USSR publications dealing with the administration and organization of Soviet science. Order 61-31508 from OTS and include 75 cents for the cost of the translation.

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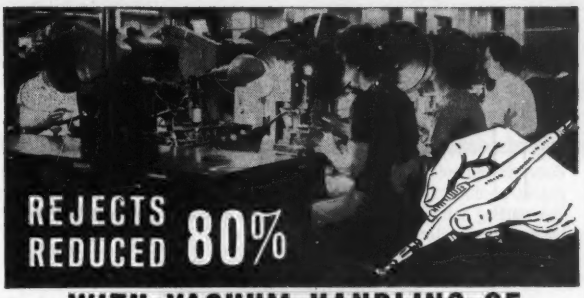


WITH VACUUM HANDLING OF MINIATURE PARTS

Individual handling of delicate, miniature ball bearing retainer rings in production press work can be a big cause of rejects. The Lacey Mfg. Company, Subsidiary of The Barden Corp., Bridgeport, Conn., solved this problem by giving each press operator an Air-Vac BAZOOKA® Vacuum Probe—with proper sized Tips—to pick up small parts. Rejects caused by bending, dropping, marring, nicking, pinching or scratching were eliminated.

At Lacey Mfg., a compressed air line runs between the two banks of 4 presses. Then, a BAZOOKA Vacuum Transducer, at each of the 8 machines, converts the compressed air to vacuum to operate the Probes.

You, too, can reduce labor costs and rejects in assembly, inspection and production work. The BAZOOKA Vacuum Probe is as easy to hold as a pencil, with fingertip "Off-On" control. And, increase metallic or non-metallic parts handling with the right Probe Tip for the job. Over 20 standard stainless or plastic Tips available from .002" I.D. and larger, with specials made to order.

Write today for FREE Vacuum Probe, Tip & Transducer Bulletins.

ALSO—FOR VACUUM CLEANING

CLEAN MINIATURE ELECTRONIC COMPONENTS WITH THE BAZOOKA® VACUUM CLEANING UNIT

The BAZOOKA Vacuum Probe with appropriate plastic tip, as small as .011" I.D., vacuums hard to reach areas that cannot be cleaned with compressed air. With the Vacuum Transducer, dust, lint, fuzz, and other foreign matter are controlled and collected.

Assemble and vacuum clean small semiconductor or electronic components, at the same time, with the BAZOOKA Vacuum Probe.

RECOMMENDATIONS GIVEN for your assembly or vacuum cleaning problems.

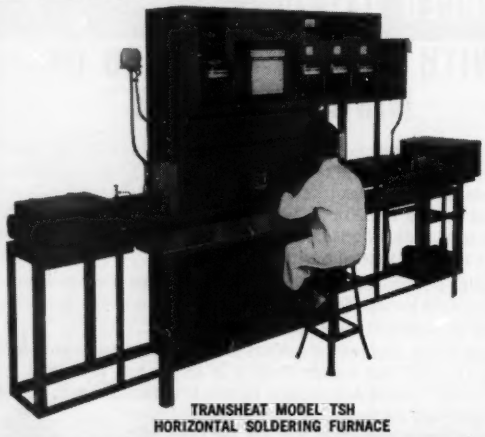
----AIR-VAC---- ENGINEERING COMPANY, INC.

100 GULF STREET, MILFORD, CONN. TR 4-2541

CIRCLE NO. 37 ON INQUIRY CARD

ELIMINATE MANUAL SOLDERING!
...AND PROBLEMS CAUSED BY FLUX

Conveyorized soldering and brazing under precisely controlled temperature and reducing atmospheres produces highly uniform results at greatly reduced costs. Flux is no longer required. The wetting action of Hydrogen is superior to that produced with flux. Result: clean oxide-free bonds and no deterioration of fixtures!



TRANSHEAT MODEL TSH
HORIZONTAL SOLDERING FURNACE

MODEL TSH has a continuous horizontal closed loop chain drive onto which boats are attached. Parts or preloaded fixtures are placed directly on the boats.

FEATURES

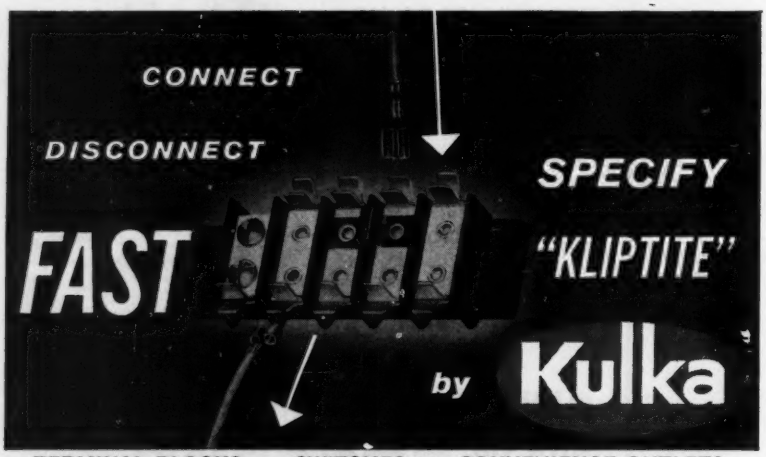
- Single station loading and unloading requiring fewer operators.
- Operating temperatures to 600° C. Temperature profile on product controlled to ±1°C.
- Exclusive BTU H_2-N_2 gas control system with fail-safe provisions.
- Higher rates of production with lower costs.
- Flexible production setups adaptable to automation.
- Desired clearances can be provided below as well as above the fixture to accommodate leads, etc.

If you have furnace problems, consult

BTU ENGINEERING CORPORATION

179 BEAR HILL ROAD, WALTHAM 54, MASSACHUSETTS, U.S.A., Tel. TW 4-6050

CIRCLE NO. 39 ON INQUIRY CARD



TERMINAL BLOCKS • SWITCHES • CONVENIENCE OUTLETS

• Just clip on wire terminal fast—for a tight connection • Disconnect just as fast • Available on KULKA'S full line of molded barrier terminal blocks, plus switches and convenience outlets • Up to 6 connections per stage • Vari-angled tabs • Available riveted to terminal hardware or with screw assembly • Designed to accept female wire terminals made by AMP, BURNDY, KENT, and ARKLES

For fast, reliable wire hook-up—and quick disconnect—KULKA'S versatile "Kliptite" terminals are unbeatable. That's why they are specified by leading manufacturers of appliances, air conditioners, vending machines, and countless other types of equipment.

"Kliptite" male tabs are electro-tinned brass for low contact resistance. They may be supplied rigidly riveted to KULKA terminal hardware, or where termination to a screw is required on the same terminal, they may be assembled under the screwhead.

See for yourself how "Kliptite" terminals can improve your assembly operation.

Write for complete details...

KULKA ELECTRIC CORP.

633-643 SO. FULTON AVENUE, MOUNT VERNON, N. Y.

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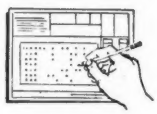
THE ABC'S OF ELECTRONIC PACKAGING

. . . ALDEN . . . using Building Block Techniques

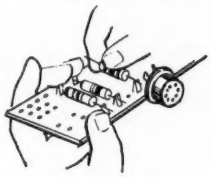
Designed by and for engineers, Alden Plug-In Unit Construction is the only complete, standard packaging system available to the electronics industry. Here's how simple it is to solve your mounting and packaging problems . . .

A

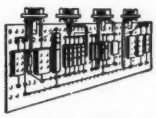
MOVE FROM SCHEMATIC TO COMPLETED CIRCUITRY IN HALF THE TIME!



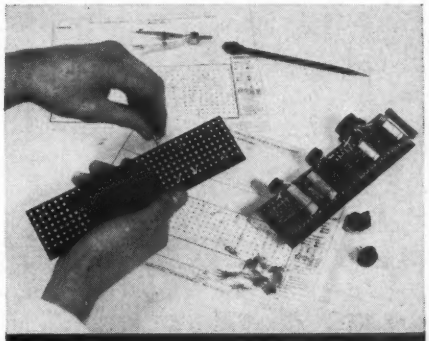
Lay out your circuitry on Alden full-scale planning sheets.



Snap component leads into ratchet jaws of Alden terminals.

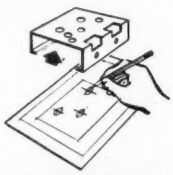


Make neat, component sub-assemblies organized into unit planes of circuitry.

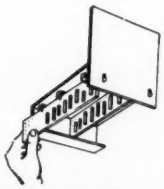


B

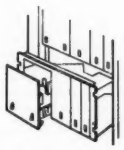
ORGANIZE YOUR CIRCUITRY BY FUNCTION FOR PLUG-IN FLEXIBILITY!



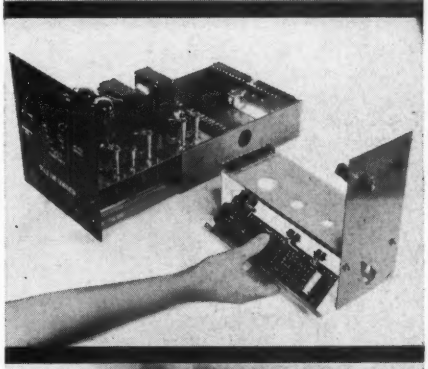
Indicate hole layout and sizes on full-scale planning sheets — complete chassis delivered to your specs.



Snap-in circuit cards in vertical planes for a neat, accessible assembly.

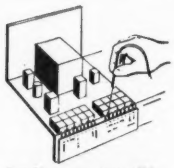


Sub-divide into modular, plug-in functions for true building block design.



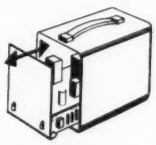
C

"DESIGN-IN" MAINTAINABILITY FOR THE REAL PAY-OFF!

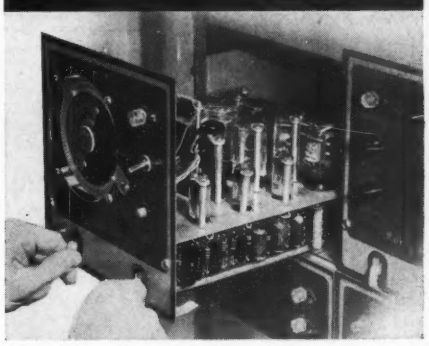


Provide an accessible point of check for all in/out leads with unmistakable graphic identification.

Get quick replacement/accessibility of plug-in chassis by simple half-turn of handle.



Modular chassis interchangeable with instrument case for dual function or as transport case for replacement chassis.



For FREE 250-page Alden Handbook, write on your company letterhead.

As the techniques of Alden Plug-In Unit Construction become more standardized throughout the world, those already designing to these standards will be setting the trends for equipment design in the rest of the industry.

You can get started now with any of the twelve Alden "Get-Started" KITS, ranging from $11.25 to $395.00. You can then evaluate — quickly—all or part of the Alden system in your particular application.

ALDEN

PRODUCTS COMPANY

10177 N. Main St., Brockton, Mass.

CIRCLE NO. 14 ON INQUIRY CARD

POST ELECTRONIC PRODUCTS and CONTROL SYSTEMS

ASSURE:

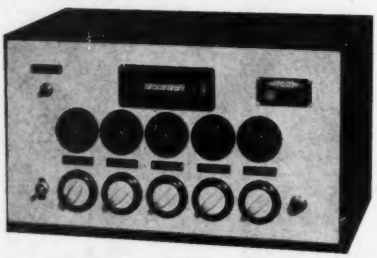
RELIABILITY • ACCURACY
LOW MAINTENANCE • PRODUCTION CONTROL

Post's *proven* electronic counters and control systems are in widespread use throughout industry. Serving such diverse needs as batch counting, measuring, sensing or machine control. Post electronic products are ideal production aids.

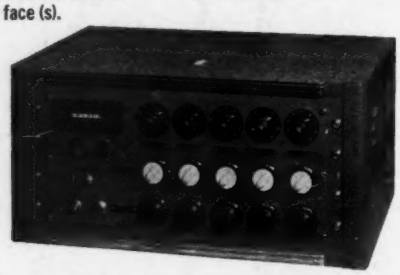
Note these examples of Post's broad line of Electronic Products...

COUNTERS

SD-1T Outmodes mechanical counters. Will operate at speeds up to 100 units per second. Single 'count' registers on visual totalizer as each 10th. item breaks beam. Note: 12 place tube available for counting dozens or gross lots.



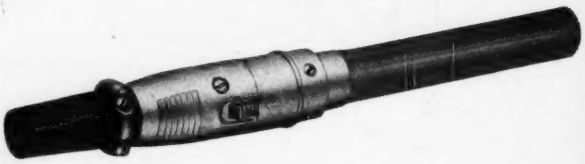
P-5 Preset counting of any desired 'batch' — 1-100,000 units. Other models available for 10,000 or 1,000,000 range. Direct 'batch' readout on all models from totalizer . . . quantity less than 'batch' shown directly on tube face (s).



PW-5 PRESET Counter with BUILT-IN WARNING SYSTEM. Model shown will 'batch' count 1-100,000 units (inclusive) and warning selection dials may be set to energize a secondary control circuit, i.e., 'Batch' count desired 5000 . . . warning count desired 4900. When warning count reached, impulse may be given to flash light, operate solenoids for opening or closing feed gates, etc.

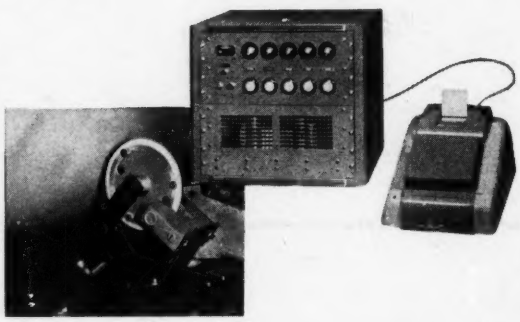
SENSING DEVICES

H-21-C A miniature, all purpose photohead. Ideal for limited space application. 'Head' not much longer than standard paper clip. Exciter lamp life 5000 hours. Utilizes photosensitive semi-conductor cell.



MH-2-P A new, compact magnetic switch in neat epoxy resin shell. . . . Magnetically operated as sensing device, the MH-2-P is capable of speeds up to 100 cycles per second — long life — no "bounce".

CONTROL SYSTEMS



LF-1A Lineal footage measurement, electronically . . . Capable of length measuring continuous production items, i.e., paper, wire, rope, ribbon, etc.
Features visual and printed readout.

D-1T
-5
W-5
-21-C
IH-2-P
F-1A

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